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Electrical World

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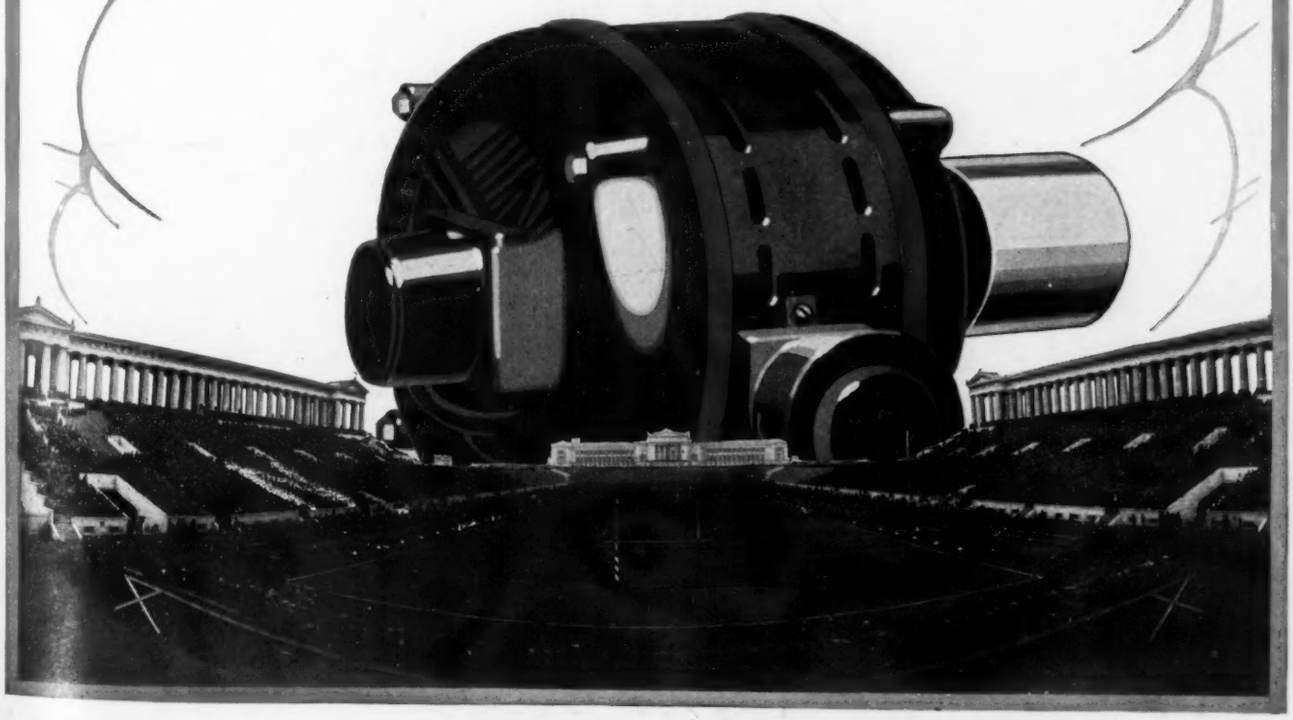
Give Red Bands your hard jobs

Howell Red Band Motors daily stand the grind of overcoming "hard jobs". That the beautiful cut stone for the New Grant Park Stadium, (Soldiers Field) Chicago, Ill., furnished by the Benedict Stone Company, Crestwood, N.Y., was cut by machinery equipped with Howell Red Band Motors, operating under the severest conditions, is but another tribute to their stamina and dependability.

Howell Red Band Motors are made in all types and sizes from ½ H. P. to 100 H. P. Howell Representatives located in all the Principal Cities are practical men on every type of motor and motor application. It will pay you to consult with them.

Howell Electric Motors Company
Howell, Michigan (68)



Howell RED BAND ELECTRIC Motors

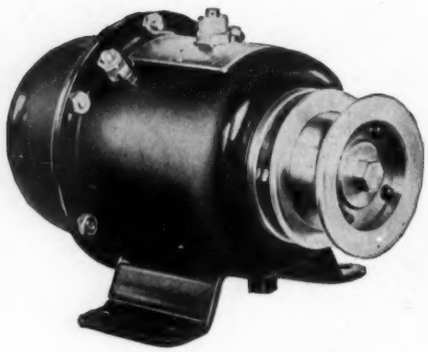
Make Good on the Hard Jobs

WESTON *Speed Indicator*
for both
Industry and Transportation

HERE is a new product of the famous Weston Laboratories which supplies an accurate and practical device far in advance of any commercial Speed Indicator so far devised. It is the Weston Model 44 Speed Indicator which, though of comparatively recent development, is already used with remarkably dependable results in a great number of industries and in both electric and steam transportation.

This device consists of a magneto driven by gear, belt or pulley, which generates a voltage directly proportional to its speed, connected by cables to a Weston Voltmeter calibrated to read in any speed units as desired.

These instruments, a number of which are illustrated below, are identical in design, except in their special adjustment and scale markings, with Weston types which have pioneered and lead in the measurement of electrical current in every field.



For Industrial Use

For speed measurement of all types of machinery in industrial plants and in general manufacture, Model 44 is supplied built lightly to withstand strain. It is easily installed in the most difficult locations. The parts are remarkably few and the assembly so simple that maintenance is not a question to be considered.

The life of this device is very long and only slight lubrication is required every twelve months.

Weston Voltmeters used in connection with Model 44 Tachometer for indicating speed — Models 1, 11, 45, 24, 271, 458, 502, 493, 241. One or more voltmeters may be connected to a single tachometer and located as desired by simply extending the connecting cables.

For Transportation Use

For every kind of transportation by land, air or water — for steam and electric locomotives, cars, dynamometer test cars, interurban electric systems, dependable speed measurements have heretofore been a difficult problem.

For this type of service the Weston Model 44 Tachometer is enclosed in a strong cast iron housing to protect it from outside shocks, excessive vibration and exposure to weather.

Temperature conditions and vibrations do not affect its accuracy.

For complete technical information regarding either industrial or transportation speed indication write

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Electrical World

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W. H. ONKEN, JR.
Editor

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Almost a Billion Already

THE central-station industry has issued a total of $908,726,010 in securities in the eleven expired months of this year. This indicates a total of a billion dollars for the year as compared with $982,420,800 in 1924, when an unusually large program in the issue of securities was put through. A large proportion of the money raised last year was spent for refunding operations because of the exceptionally good money-market conditions. This year most of the money raised has gone into property additions and extensions to meet the demands for service.

Recent announcements of dividends by utility companies show that the enormous sums of money raised by the utilities have been spent wisely, for each utility has been able to augment its surplus and pay dividends. Measured by any test for prosperity, the central-station industry is sound, and it is sufficiently courageous to continue to build and to extend its facilities for rendering greater and better electric service to America.

Progress Through Elimination of Waste

WHILE the progress made by the electric light and power industry toward greater and greater efficiency is quite generally known and appreciated, the extent to which waste has been reduced in other basic industries is not fully realized. This is chiefly due to the fact that the cost of electricity has been reduced to the ultimate consumer, whereas in other industries the cost, while it has not been reduced to the same extent, has been kept from rising to greater heights. This accomplishment, although not instantly apparent, is a welcome fact none the less.

The annual report of the Secretary of Commerce shows in a convincing way just what progress has been made in the elimination of waste—not individual or willful waste, but those wastes which can be reduced by co-operative action in the community and in industry. Secretary Hoover makes no attempt to measure our increased national efficiency, but by means of comparative wage rates and prices shows the astonishing transformation which has taken place in the economic history of the country since 1920. The railroads, inland waterways, construction industries and others all show high rates of production, greater efficiency in management and labor, higher wages—in short, we have attained the highest standards of living in all history. This has been brought about mainly through partial elimination of waste. More remains to be done, and with the active support of industry greater economies can be won to the advantage of all. One has but to study the problem and interpret the results in the light of present experience to be convinced of the truth of Secretary Hoover's contentions. If progress along these lines can be maintained, the example set by "big business" will surely prove contagious and, without becoming parsimonious, the American people will lose their reputation for extravagance and waste.

Relaying of Power by Intermediate Transmission Systems

IN CERTAIN parts of the country much satisfaction is being obtained in the relaying of power from one station to another at a considerable distance by way of intermediate companies having interconnected transmission systems. While such operation may be of great advantage and is entirely feasible, it has, however, inherent limitations which are important and which are likely to prevent its ever having any large-scale general application.

In the first place, the relayed power must go over the same lines as the relaying companies' own load and simultaneously. While over a portion of the route it may be in the reverse direction from the local load, it will in general be in the same direction as the local load a part of the way. This means that local line capacity unused by the local load must be available. Such capacity may sometimes happen to be available but can be counted on for regular service only when definitely reserved for that purpose, in which case it constitutes additional plant held by the relaying company for the foreign service.

In the second place, the passage of the foreign power over the local line of the relaying company has a tendency to disturb the local voltage. This will be corrected usually by the proper adjustment of the wattless components, which means that the relaying company must have available additional capacity for supplying wattless, usually lagging, at the proper points, and this must be reserved for foreign use if this method of operation is regularly to be relied upon.

In the third place, the energy losses are those appertaining to the actual voltage used in the transmission and will usually tend to be very high, not only because the local transmission voltage will be too low for the most economical transmission for the full distance, but because the local lines already have load on them and the losses depend upon the square of the total current.

In general it may be pointed out that the transmission from the original power house to its destination is actually carried out at the existing voltages of the intervening lines, which will usually be uneconomically low, giving high losses and great voltage disturbance. These difficulties do not show conspicuously in actual service merely because they are divided up between the several companies handling the power and because they are scrambled together with similar losses due to local loads. Similarly with power-factor-correction apparatus. Furthermore, such power transfer is possible only because the relaying companies happen to have idle load capacity in lines that they are willing to use. It is at

its best for breakdown service or as an emergency measure at times of low water in hydro plants, which usually occur when loads are in general light in the district and idle capacity is likely to be available. In such cases efficiency and line losses are of little importance.

A Byproduct of Interconnection

OCTOBER 12, 1925 (Columbus Day), was a holiday in Massachusetts, but "business as usual" prevailed in Connecticut. Thanks to interconnection between the Turners Falls, Springfield and Hartford companies, water power which was not in demand in the Bay State on that day was sent into Connecticut, enabling steam-plant operation at Hartford to be stopped and carrying the entire load of that important commercial and industrial center. With the small storage available in the Lower Connecticut Valley, there would have been a double loss of hydro-electric power and fuel had there been no tie line between the systems.

Perhaps it is a misnomer to refer to this sort of conservation as a byproduct; but the facility with which local conditions can be taken advantage of under skillfully handled "tie-ins" gives fresh emphasis to their economic value and public benefit. All along the line interconnection makes possible savings that penetrate far into the fabric of company operation and work for the public good in the side streets as well as in the main thoroughfares of business activity. Yet this sort of thing is still attacked by cranks and demagogues as evidence of dire plots and machinations on the part of a "superpower trust"!

Air Refrigeration in Large Buildings

SUMMER cooling of large buildings by means of electric refrigeration, air conditioning and ventilation offers a field for additional load development that can be profitably cultivated by electric utilities. Coming at a time of the year when most companies are anxious to fill up the valleys in their load curves, it is a most attractive business which can be taken on at rates advantageous both to the customer and the power company.

So far the most conspicuous installations have been made in theaters, and while the initial cost has been considerable, the owners have capitalized the fact that inside their buildings the temperature is fifteen or twenty degrees cooler than on the street. The actual cost of such equipment varies quite widely, depending upon local conditions. However, for a 400-ton plant which would cool a house with about 6,000 seats the cost, including ventilating fans, would be between $100,000 and $150,000. With energy at 2 cents per kilowatt-hour the cost to operate would be in the neighborhood of $20 per day per 1,000 seats for twelve hours' operation. Assuming that all the seats were filled twice daily as an average, the cost per patron would be 1 cent, a figure which has not deterred a number of theater managers, alive to the advertising value of the plan, from making the investment.

The extent to which this class of load has been developed is shown by its growth in Chicago, where the Commonwealth Edison Company has on its lines upward of twenty theaters equipped with cooling systems, besides several restaurants and hotel dining rooms. One of the newer Chicago picture houses has a connected load of 1,100 kw. for lighting and 1,000 kw. for power, most of the latter being for air cooling and ventilation.

While the theaters have been the leaders in making the most complete use of refrigeration for cooling their auditoriums, partial installations have been made in banks, offices and department stores. The field of application is by no means limited, for it is a service that is badly needed in every commercial building in the summer time and can conceivably be extended even to the home. It presents an attractive power load for the central-station company and makes possible a further extension of electric service which will be fully appreciated by the public.

Statistical Responsibilities in Smaller Companies

PRESS of work in smaller central stations and especially the diversity of tasks which fall upon the shoulders of their executives and department heads complicate the problem of organizing and maintaining an adequate statistical service in many such companies. Here syndicate management scores one of its chief hits, for small locally operated properties cannot afford to maintain an engineering and operating organization sufficient to perform functions of the consulting type, and even the preparation of analytical data comes hard to the few men available for such activities. Accounting data are more readily to be had in view of the requirements of commission regulation and the progress of the N. E. L. A. classification. Where the shoe really pinches is in the realm of technical statistics, graphic records and their continuous supply and interpretation. Fortunately the situation is far from hopeless, and a way out may be found in the closer co-ordination of the work of the load dispatcher with the needs of the engineering service.

With the advance of interconnection and the centralization of plant control on single systems, the work of the system operator has been put on a higher plane of importance than formerly. There is now a tendency toward furnishing the system operator with clerical assistance during the daytime and allotting space and material for the building up of statistical files in his department which go beyond the usual data drawn and integrated from plant logs. Such files furnish information of basic value to the management and its engineering personnel.

An excellent instance of this practice is afforded by the Vermont Hydro-Electric Corporation, whose system-operating office at Rutland maintains in loose-leaf and card-index form a large quantity of data upon the physical characteristics of the property and upon its personnel, equipment and development often not available on systems of moderate or small size as measured by the output yardstick. This general scheme of making the operating department a center of more comprehensive information in co-operation with adjacent engineering and drafting departmental quarters is constantly growing in value and scope and is widely applicable. Load-dispatching offices on all properties are intrinsically operating data centers, but at Rutland the co-

ordination of engineering information with system handling has been carried to a degree of usefulness that goes far toward solving the statistical problems involved in routine analysis and contributes not a little to special inquiries bearing upon property development. It is not claimed that the above example is unique, but it typifies a means of weaving statistics so deeply into the daily affairs of the company as to facilitate better service and more efficient development.

Arc Welding in Manufacture and Construction

ALL the big possibilities in electric arc welding are not yet fully realized. The process still continues to be accepted as one to be used largely in repair work instead of as one which augments the facilities for manufacture and construction. Decided innovations have been made in construction work recently. Several buildings and bridges have been erected in which the entire fabrication was done by welding. In the manufacture of many machines arc welding has been found to facilitate production in that it permits the use of steel instead of cast iron and enables many fabrication jobs to be done more quickly and economically.

Central-station companies can do much to further the advance of electric arc welding and should do so. Welding equipment gives a good load on the lines, because great improvements have been made in the apparatus and controls so that poor power factors and peak-load fluctuations no longer are characteristic of the process. In many cases central-station companies can use arc welding on their own jobs and on jobs which they specify and thus practice what they preach. Power salesmen should know the possibilities of arc welding thoroughly in order to advise customers of its advantages and disadvantages. They should have data at hand to give definite answers to questions about power consumption, process, details, effect on strength of materials and the special equipment available for process application. The further development of arc welding is an educational job in which every electrical man should be interested.

Good Engineering Deserves Good Business Management

WHEN a modern power company wants to build a great generating station it is quite common to call in some eminent engineering firm to do the job. This is no reflection on the local engineering staff. The men who compose it have their regular work to do, and it is not reasonable to expect them to assume in addition the responsibility for a huge construction project in which millions of dollars must be spent. So the best talent available is retained, and the cost of this expert service it not counted too much. What happens, then, when the plant, representing, say, an investment of twenty million dollars, is ready to be put into production? Too often the responsibility for making a prompt business success of this new enterprise is left in the hands of an undermanned, underpaid, underskilled sales department, already inadequate for its appointed task of market development.

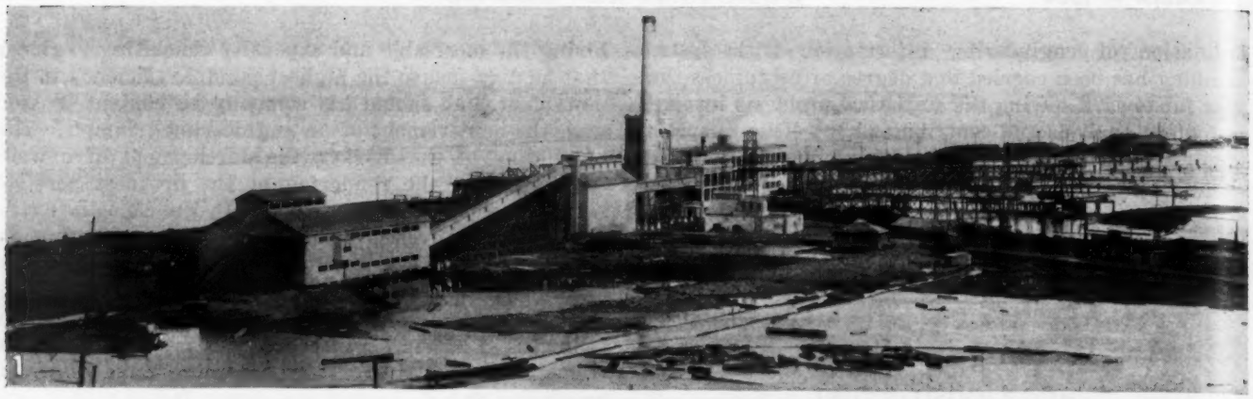
No executive will question the sound economy of hiring the most able and expensive consulting engineer that he may insure the highest possible efficiency in the new plant, but should his company be content to stop with the achievement of an engineering triumph? The upbuilding of the market, the development of a well-balanced load, the rendering of the broadest possible service to the greatest number with the capacity available—is this any less honorable or less interesting an objective? Is it not worthy of the same consideration and the same care?

The central-station industry has not done as well in selling as it has in engineering. Its progress has been tremendous, but it has been traveling on a wave of popularity and its market has grown faster than it has followed. The big job ahead is to achieve the high ideal of universal use of electric service in all its applications. It is this end toward which all the preparation of plant and system has been pointed. This is the purpose of it all. And to accomplish any satisfying progress on the greater scale which now seems to be not only possible but necessary the planning and organization of the sales function deserves as high a type of expert advice and services as is invoked today in engineering. A great generating system deserves the kind of commercial leadership that can be secured only through the employment of an experienced and successful specialist in sales management, and such a man demands and is entitled to high pay.

Statistics and Competition

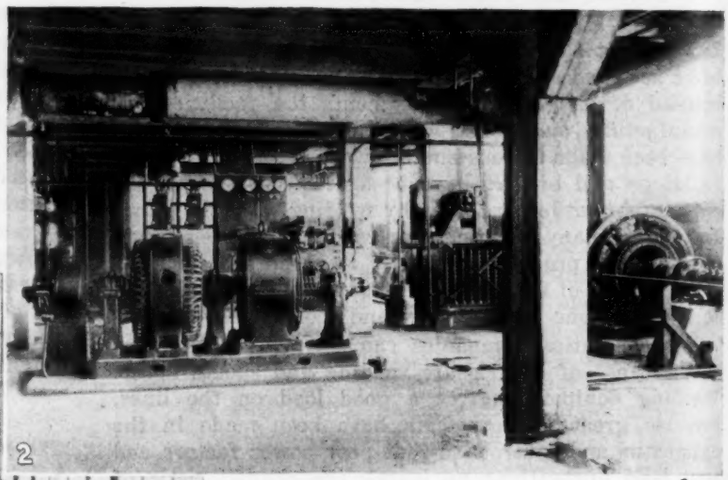
AS A PROMINENT executive phrased it recently, the electrical industry can stand any amount of competition among manufacturers who are making money. The danger comes when men who do not know their costs set prices on their products that are regulated primarily to undersell their competitors, instead of being accurately adjusted to produce an adequate and legitimate profit. Such a policy is an unjustifiable menace both to the manufacturing industry and to the public itself, for, be the cause what it may, no manufacturer can, through price cutting, debauch his earning power and the earning power of his competitors without weakening the industry and restricting its capacity for service to the public.

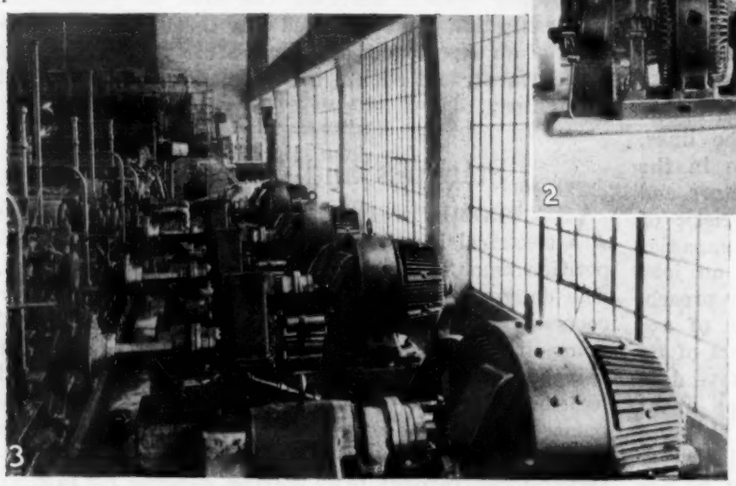
The recent action of the United States Supreme Court on the maple-flooring and cement cases has dissipated the fear of government interference in the compilation and exchange of production, cost and sales statistics among groups of manufacturers and distributors. Fortunately this has already been reflected in the increasing interest evinced by the electrical manufacturing and jobbing industries. At the recent meetings of both the Electric Power Club and the Associated Manufacturers of Electrical Supplies the subject of comparative statistics was under discussion, and it is now being considered by these groups. The matter was up also before the Electrical Supply Jobbers' Association in Buffalo week before last and is now in the hands of a committee. The advantage to an industry of such a knowledge of production, costs, stocks and sales is just the same as in the case of an individual producer. It is a bulwark to business judgment and a safeguard against that waste of profits that is the inevitable price of guessing either at costs or the requirements of the market. It raises competition to a more intelligent plane.



Electric Power for Paper Making

THE paper industry has been rather completely electrified and has developed into one of the greatest employers of electric power. The control problems in this industry have been solved in a series of remarkable engineering developments. In the Northwest and in other paper-making districts electric power for paper making has proved very popular.





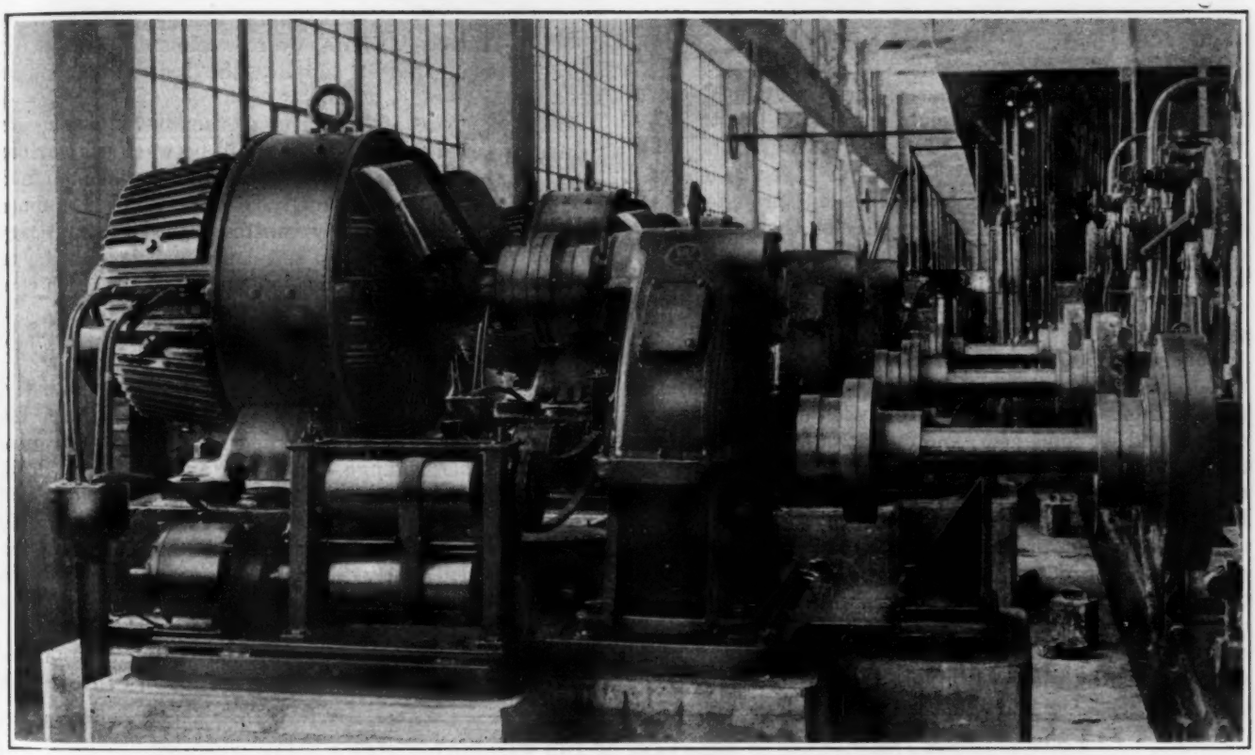
Views of the Washington Pulp & Paper Company Mill at Port Angeles, Wash.

1. General view of plant.
2. Motor-generator, motors and control for single-motor-drive paper machine.
3. Motor side of the sectional-drive paper machines showing drives to press and couch sections.
4. Hydro plant of the Northwest Power Company, which is the principal source of power supply for the mill.

Electric Drive in a Modern Paper Mill

Washington Pulp & Paper Company's Plant at Port Angeles, Wash., Represents the Latest Practice in Paper Mill Drive —Applications of Synchronous Motors to Pulp Grinders

By O. C. CORDES and B. L. KERNS
Westinghouse Electric & Manufacturing Company



CLOSE-UP VIEW OF ONE OF THE MOTORS ON THE SECTIONAL DRIVE PAPER MACHINE, SHOWING GEAR AND REGULATING APPARATUS MOUNTED ON COMMON BEDPLATE

KEEN competition in the paper-making industry today makes it necessary, in choosing the location for a new plant, to pay particular attention to its centralization with respect to raw materials, fuel, labor and market. The site of the Washington Pulp & Paper Company's mill at Port Angeles, Wash., on the strait of Juan de Fuca, was selected and the plant laid out to conform to these conditions. In all respects it is one of the most modern paper mills in the country and may be rightfully pointed to as the last word in paper-mill construction, layout and apparatus installed.

The plant is located on the Olympian Peninsula in northwestern Washington, adjacent to the largest stand of available virgin timber left in this country, which insures a constant source of pulp-wood supply for a long period of time. The fuel used consists chiefly of wood refuse and some oil, which furnishes the heat necessary to provide steam for process and drying and for operating a steam turbine in the mill at times of low water. With the exception of a small amount of energy generated at the mill from process steam, power is furnished by the Northwest Power Company. This company has a hydro-electric plant on the Elwah River about six miles from Port Angeles. Power rates are very favorable and are fixed for a long term of years.

The mill of the Washington Pulp & Paper Company has recently passed through a period of extensive expansion in that the average daily output has been increased to 150 tons of paper per day and a sulphite mill has been added. This has naturally resulted in the installation of much new machinery and apparatus, all of which is driven by motors in the most approved and economical manner. Each motor and control has been applied after a careful study of the conditions, as regards drive and application, to be met for each individual case. It is particularly interesting to note that for a large number of machines individual motor drive is employed. This has been accomplished by the aid of flexible couplings, silent chain, gear reduction and belt drives; the type of drive having been carefully selected for each case to suit the particular application.

Paper Manufacture

Newsprint of 32 lb. weight basis is manufactured exclusively. It consists essentially of ground wood and sulphite pulp with small amounts of color, size and filler. The sequence of operation and manufacture is shown in the chart on page 1146. The process in paper manufacture is, briefly, as follows: The logs are sawed into 4-ft. lengths and split by machine into pieces simi-

lar to cord wood. After being barked, the wood divides, part going to the grinders for mechanical pulp and part to chippers for preparation for the chemical process.

Ground wood pulp and sulphite pulp in the correct proportions are mixed with the proper amount of color, size and filler and are fed into beaters and mixers, where the pulp is prepared into stock for the paper machines. The stock is finally fed onto the Fourdrinier wire of the paper machines, where it is formed into a sheet and passes through the various sections of the paper machine. Throughout the process a monorail system and various types of conveyors and pumps are used for handling the wood, pulp and water.

Power Distribution

At the mill substation the voltage is stepped down from the incoming 66,000-volt transmission line to 2,200 volts and 440 volts for distribution through the mill. The substation contains two banks of three 2,000-kva., single-phase, sixty-cycle, water-cooled transformers. Seventy-five per cent of the capacity of the low-tension windings is available at 2,200 volts and 25 per cent at 440 volts. Power is distributed through the mill by means of a thirty-four-panel switchboard located in the mill substation.

Generating equipment in the mill consists of one 3,000-kw., 3,600-r.p.m., 2,200-volt, three-phase, sixty-cycle, condensing turbo-generator, with direct-connected exciter and jet condenser, and one 2,500-kva., 120-r.p.m., 2,200-volt, three-phase, sixty-cycle generator, direct connected to a Nordberg uniflow non-condensing engine. Low-pressure steam for drying and process purposes is taken from the steam engine after a considerable amount of byproduct power has been extracted. The turbo unit is used principally as a standby power source during periods of low water. All of this electrical equipment, as well as the motors throughout the mill, was supplied by the Westinghouse Electric & Manufacturing Company. In the boiler room there is, in addition to the usual fuel-burning equipment, a 500-hp. electric boiler which converts any surplus water power into steam. The electric boiler also permits banking the fuel-burning boilers over week-ends and other shut-downs in that it supplies the required steam at little cost.

TABLE II—MOTOR-GENERATOR DATA

Apparatus	No.	Kw.	Volts A.C. Motor	Volts D.C. Generator
Paper machine				
Single motor	1	250	2,200	250
Sectional drive	1	600	2,200	250
Exciter	1	3 & 15	440	250
Grinder motors	2	75	2,200	250
Grinder motors	1	400	2,200	250
Grinder motors	1	200	2,200	250

Various types of centrifugal vacuum and plunger pumps are used throughout the mill between the various steps in the process for compressed air, vacuum and handling of the large quantity of water. These pumps are individually driven by constant-speed squirrel-cage motors, flexibly coupled to self-contained gear units, or through a silent chain drive. The motors are each controlled by a standard auto-starter.

Motors, Drives and Control

Each motor in the mill is provided with an ammeter, so that the personnel in charge can tell at a glance the load on the motor and be warned in advance of trouble by any sudden change from the average daily load. Each control equipment is provided with overload and low-voltage protection. The ratio of synchronous apparatus to induction apparatus is such that the mill power factor is very nearly 95 per cent at all times. The general rule followed in selecting motors was to operate all motors below 50 hp., on 440 volts, three phase, sixty cycles, and those above 50 hp. on 2,200 volts, three phase, sixty cycles. Useful data on motors throughout

TABLE I—MOTOR APPLICATIONS IN THE PLANT OF THE WASHINGTON PULP & PAPER COMPANY

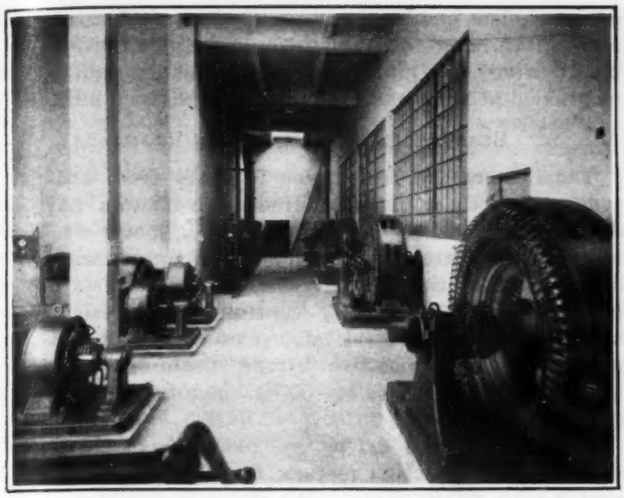
Alternating-Current, Three-Phase, Sixty-Cycle Motors

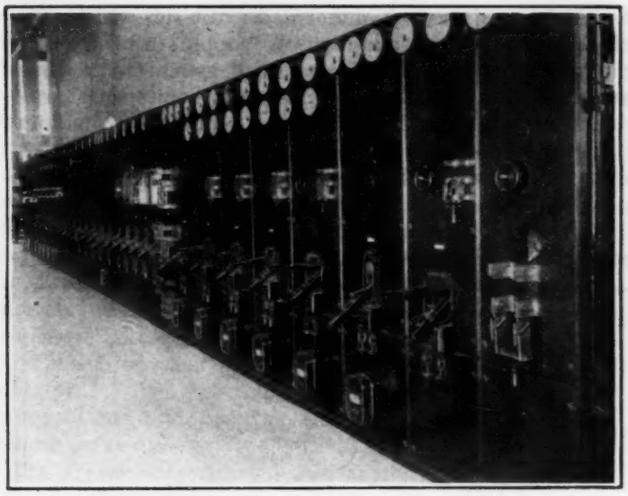
Equipment Driven	No. of Motors	Hp.	R.p.m.	Voltage	Type*	Drive
Log haul	1	30	690	440	CW	Gear
Cut-off saws	2	75	690	440	CW	Belt
Conveyors						
Chipper	2	7.5	1,160	440	CS	Gear
Splitters	2	5	1,160	440	CS	Gear
Refuse	2	5	1,160	440	CS	Gear
Fuel	1	10	1,160	440	CS	Gear
Barker	1	10	1,160	440	CS	Gear
Chip	2	5	1,160	440	CS	Gear
Sulphur	2	5	1,160	440	CS	Gear
Miscellaneous	1	5	1,160	440	CS	Gear
Miscellaneous	2	7.5	1,160	440	CS	Gear
Chip elevator	1	5	1,160	440	CS	Gear
Chip bin gate	1	5	1,160	440	CS	Gear
Disk barkers	7	25	500	440	CW	Coupled
Hogs	2	150	690	2,200	CW	Coupled
Grinders	9	1,000	240	2,200	Syn.	Coupled
Chipper	1	150	575	2,200	W.R.	Belt
Box end chipper	1	20	1,160	440	CS	Coupled
Chip screen	1	10	870	440	CS	Belt
Sulphur burner	2	3	1,160	440	CS	Gear
Sulphur blower	2	5	1,160	440	CS	Coupled
Knotters	4	5	1,160	440	CS	Gear
Screens						
Centrifugal	3	40	1,160	440	CS	Chain
Centrifugal	2	30	1,160	440	CS	Chain
Flat (five in row)	4	40	1,160	440	CS	Coupled
Tailing (2)	1	5	1,160	440	CS	Gear
Deckers	2	5	1,160	440	CS	Gear
Pneumatic (4)	4	5	1,160	440	CS	Gear
Pneumatic (4)	2	10	1,160	440	CS	Gear
Refiners	2	50	500	440	CS	Coupled
Refiners	2	75	500	440	CS	Coupled
Lap machines	3	15	1,160	440	CS	Gear
Lap machines	2	10	1,160	440	CS	Gear
Lap machines	4	3	1,160	440	CS	Gear
Save-alls	2	5	1,160	440	CS	Gear
Compressors	2	50	1,160	440	CS	Chain
Agitators						
Stock chest	4	7.5	1,160	440	CS	Gear
Stock chest	4	10	1,160	440	CS	Gear
Color, size, etc	4	3	1,160	440	CS	Gear
Beaters						
Regular	3	125	380	2,200	CW	Belt
Broke	2	50	380	440	CW	Belt
Jordans	2	200	325	2,200	CS	Coupled
Paper machine						
Constant speed	1	60	690	2,200	CW	Belted
Winder	1	40	1,160	440	CS	Belted
Vacuum pump	1	60	1,160	2,200	CS	Coupled
Stock pump	2	7.5	1,160	440	CS	Gear
Screens (2)	1	5	1,750	440	CS	Belt
Screens (4)	1	10	1,700	440	CS	Gear
Felt stretchers	4	3	1,160	440	CS	Coupled
Filter pumps						
Centrifugal	2	75	1,160	2,200	CS	Coupled
Centrifugal	1	50	1,160	2,200	CS	Coupled
Centrifugal	2	30	1,160	440	CS	Coupled
Water pumps						
Centrifugal	1	100	1,160	2,200	CS	Coupled
Centrifugal	1	50	1,160	2,200	CS	Coupled
Stock pumps						
Vertical cent	2	15	1,160	440	CS	Coupled
Centrifugal	1	50	1,160	2,200	CS	Coupled
Centrifugal	1	30	1,160	440	CS	Coupled
Centrifugal	1	25	1,160	440	CS	Coupled
Centrifugal	2	10	1,160	440	CS	Coupled
Centrifugal	2	7.5	1,160	440	CS	Coupled
Tailing pump	1	5	1,160	440	CS	Coupled
Acid pumps						
Centrifugal	1	40	1,160	440	CS	Coupled
Centrifugal	1	15	1,160	440	CS	Coupled

* CW and WR = Wound rotor. CS = Squirrel cage.

Direct-Current Motors

Paper machine						
Single motor	1	300	116/700	250	Q	Coupled
Sectional drive						
Couch	1	125	660	250	SK	Geared
Presses	4	80	750	250	SK	Geared
Driers	2	150	700	250	SK	Geared
Calender	1	125	660	250	SK	Geared
Reel	1	20	900	250	SK	Geared
Winder	1	40	275	250	SK	Coupled
Monorail	9	10–15	500	250	P&H	Geared





AT LEFT—PARTIAL VIEW OF THE NINE 1,000-HP. SYNCHRONOUS MOTORS DRIVING THE WOOD PULP GRINDERS. AT RIGHT—POWER IS DISTRIBUTED THROUGHOUT THE PLANT BY A THIRTY-FOUR-PANEL SWITCHBOARD IN THE MILL SUBSTATION

The grinders are located on the opposite side of the wall from the motors shown at the left and are direct connected to the motors through shaft extensions

the mill are given in Table I. Motor-generator sets are listed in Table II.

The log haul is driven by a standard 25-hp. constant-speed squirrel-cage motor through a suitable mechanical reduction gear to give the desired speed. Control is a standard type auto-starter. The slasher saws are each driven by a standard 75-hp. wound rotor induction motor through a belt and pulley reduction. The control consists of a primary switch, secondary resistance and drum controller.

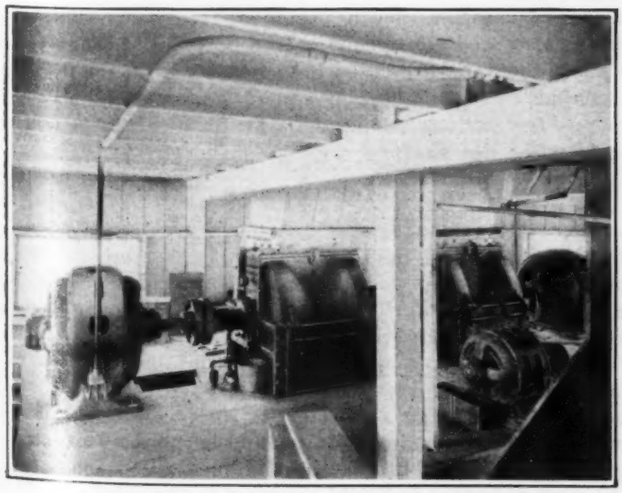
The conveyors for transporting the logs to the several machines and the refuse to the hogs and boilers are driven by either squirrel-cage or wound-rotor motors, depending upon whether or not speed adjustment is desired. These motors are geared to the intake shaft through the desired reduction ratio. The control is a standard type auto-starter or primary switch with secondary resistance and drum controller.

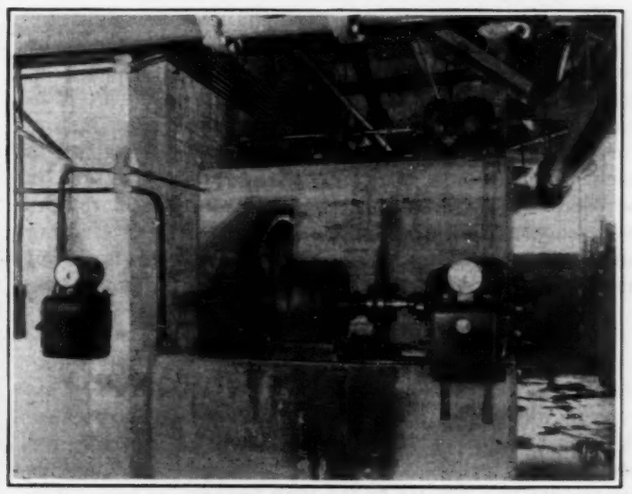
The disk barkers are each driven by a 25-hp. wound-rotor induction motor, which is directly coupled to the intake shaft and operates at constant speed. The wound-rotor motor was selected for this application to take care of the flywheel starting and accelerating torque characteristics inherent to these machines. Control consists of a primary switch, secondary controller, secondary resistance and protective devices.

The hogs, which operate at constant speed, are each driven by a 150-hp. wound-rotor induction motor, directly coupled to the intake shaft of the hog. A wound-rotor motor was selected for this application because of its high starting and accelerating torque. The control consists of a primary switch, secondary controller, secondary resistance and protective devices, all mounted on a common panel.

GROUND WOOD MILL

Each of the nine pulp grinders is driven by a 1,000-hp. synchronous motor, to which it is flexibly coupled. The synchronous motors are located in a room adjacent to the grinder room and are provided with special shaft extensions, which extend through the common wall into the grinder room, where they couple to the grinder intake shafts. Synchronous motors were selected for this drive because of their greater economy and their ability to maintain a high plant power factor. These motors are started by means of a 400-kva., 2,200-volt,



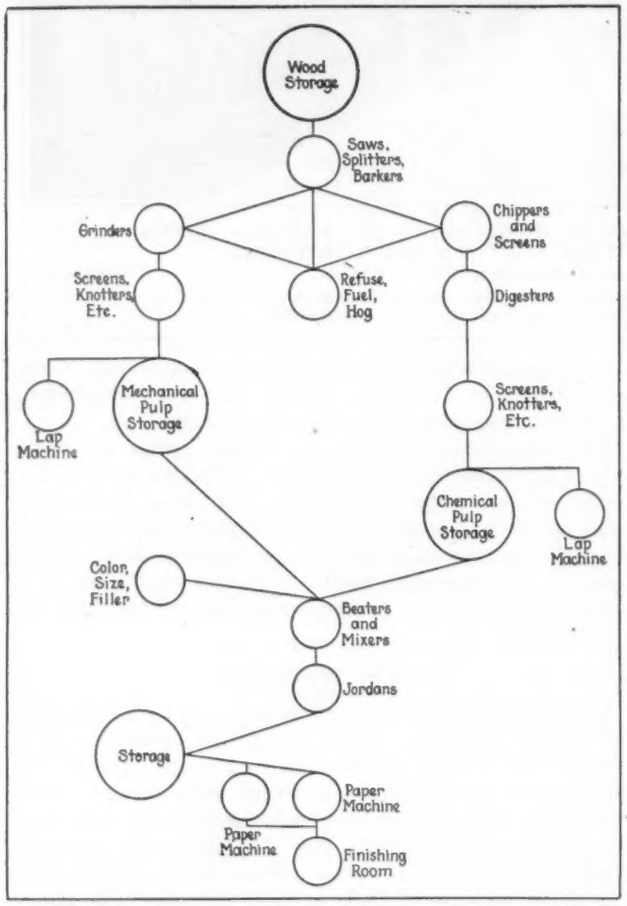


AT LEFT—MOTORS DIRECT CONNECTED TO REFUSE FUEL "HOGS." AT RIGHT—INDIVIDUAL DRIVE ON AGITATORS THROUGH GEAR REDUCTION

Note in the view at the right the unit type of starter and ammeter used on the principal motors throughout the mill

three-phase, sixty-cycle motor-generator set, which synchronizes with the main power supply to which the motor is transferred at the point of synchronism, thus avoiding the high starting current common to such large motors. For excitation of the synchronous motors there are two 75-kw., 250-volt exciter motor-generator sets, either one of which can handle the entire excitation load.

The knotter, screen decker, wet machine and agitator equipment is divided into two groups. The smaller of



FLOW CHART SHOWING SUCCESSIVE STEPS IN THE MANUFACTURE OF NEWSPRINT FROM WOOD PULP

these groups contains the first equipment bought for this mill and is largely belt driven from line shafts by constant-speed squirrel-cage motors. The machinery contained in the larger and newer group is all individually driven by constant-speed squirrel-cage motors through self-contained gear reductions. The control in each case consists of a standard auto-starter or an across-the-line type of switch. Squirrel-cage motors were chosen for these applications because the starting and running characteristics of the several types of machines are very favorable to this class of motor.

SULPHITE MILL

The chipper is driven by a 150-hp. wound-rotor induction motor, to which it is connected by a belt. This type of motor was selected for this application because it is best suited to take care of the high starting and accelerating torque inherent to this machine, which has characteristics similar to the disk barkers or hogs. The control consists essentially of a primary switch, a secondary controller, secondary resistance and protective devices. The knotters, screens, deckers, wet machines and agitators in the sulphite mill are all individually motor driven in a manner similar to the new equipment mentioned above contained in the ground-wood mill.

BEATER, MIXING AND JORDAN ROOM

The beaters are belt driven in pairs from 125-hp., constant-speed, wound-rotor induction motors having double extended shafts. A wound-rotor motor was selected to take care of the high starting torque and slow acceleration of the beater. The control consists of a primary switch, secondary controller and resistance, and the required protective devices all mounted as a panel. There are also two "Broke" beaters, which are individually driven, using 50-hp. motors and control similar to the above.

The jordans are driven by 200-hp. constant-speed squirrel-cage induction motors, flexibly coupled to the jordan plug intake shaft. The motor is mounted on a sliding bedplate that moves in and out with the plug. A squirrel-cage motor, under the conditions existing in this mill, makes a suitable application for jordan drive. Where power factor correction is required, a synchronous motor makes an ideal application. The control consists of a standard type of auto-starter.

The color, size and filler are contained in storage tanks, which are constantly agitated by small constant-speed squirrel-cage motors that connect to the intake shaft through self-contained gear reductions. The control for these motors consists of across-the-line type starters.

In the paper machine room there are installed two 164-in. Fourdrinier paper machines. The first of these to be installed was provided with single-motor direct-current drive and the second one with a sectional paper machine drive, both of which were furnished by the Westinghouse Electric & Manufacturing Company.

The synchronous-motor drive consists of a single direct-current separately excited motor directly coupled into the variable speed line shaft from which each of the paper machine sections is driven; a synchronous motor-generator set with direct-coupled exciter and a full automatic push button type of control. The entire speed range of 115 ft. to 700 ft. per minute is obtained by means of generator voltage and motor field adjustment whereby the speed of the motor is changed. Starting and stopping of the paper machine drive, as well as speed adjustment, is all obtained from push button stations located convenient to the operators. The constant-speed apparatus used in connection with the paper machine, consisting largely of stock pumps and water pumps for various purposes, is all driven from a constant-speed line shaft.

SECTIONAL DRIVE

The sectional paper machine drive provides a separate direct-current motor for each of the nine sections of the machine, as follows: couch, first press, second press, third press, fourth press, first drier section, second drier section, calender and reel. Each motor is flexibly coupled to a high-grade self-contained Westinghouse helical gear reduction equipped with taper roller bearings and having a ratio of 5.1 to 1. This, together with the section control equipment, is mounted as one unit on a common bedplate. The slow speed shaft of the gear reduction is flexibly coupled to the intake shaft of the paper machine section through a suitable mechanical arrangement designed to provide ample pro-

tection against misalignment. Power is supplied to this drive by a synchronous motor-generator. A three-unit exciter set provides excitation for the several motors, the synchronous motor and the generator.

A control board carries the various control apparatus required for the motor-generator, exciter sets, regulator and the automatically operated starting equipment and instruments for the different sections. The synchronous motor-generator set, the exciter set and the control panel are located in the basement under the paper machine room. The designed paper speed range of 400 ft. to 1,200 ft. per minute is obtainable by adjusting the armature voltage of the generator. Speed regulation equipment at each section consists of small regulating units and speed changers, which, in conjunction with a master unit, are utilized to maintain each motor at its proper speed.

Full Automatic Control Used

The control for this drive is full automatic and includes the rotary contactor type of regulating system as developed by the Westinghouse company especially for paper-machine sectional drive. By means of the regulating system, the relative speed of the various sections is kept in the correct relation, and the "draw" between sections is maintained at the value set by the operators. Push button control stations located in convenient positions permit the operators to adjust the paper speed upward or downward as desired. From these stations any section can be started, inched or stopped as desired, while the regulating system maintains the "draw" between the other sections of the paper machine in proper adjustment. This machine is at present making paper at the rate of 1,060 ft. per minute, and a uniformly high operating efficiency has been continually maintained.

The winder at the end of the sectional drive paper machine is driven by a direct-current motor that operates in conjunction with an induction motor-generator set. Both the motor and generator are separately excited machines, and all speed adjustment of the winder is obtained by changing the generator voltage. The control consists essentially of a standard type auto-starter for starting the motor-generator set, a generator field rheostat of special design and line contactors for connecting the motor to the generator. All starting and stopping of the winder are accomplished by turning the field rheostat. The first point closes the contactor between the motor and generator at a low voltage; subsequent points serve to increase the speed of the motor. Regenerative braking is obtained by rapidly moving the field rheostat to the first position. The slitter is separately driven by a constant-speed squirrel-cage motor coupled to the intake shaft. An across-the-line type of starter is used for this motor.

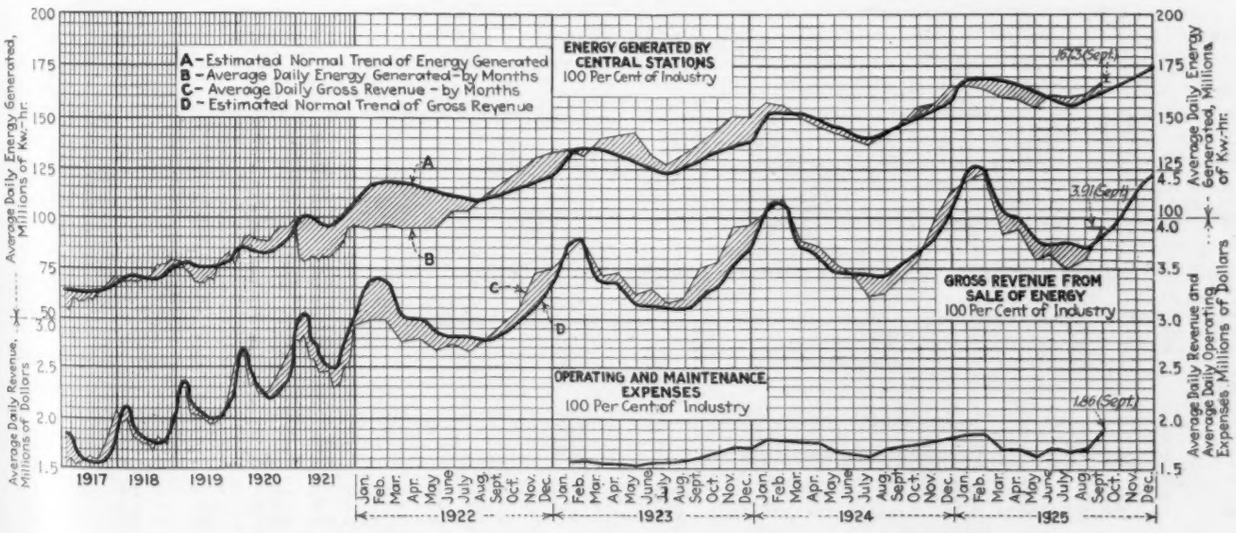
The constant-speed apparatus used in connection with the sectional drive paper machine is all individually driven by constant-speed squirrel-cage motors through self-contained gear reductions or silent chain. The control used in each case consists of a standard auto-starter. A squirrel-cage motor is best suited for those applications and has the requisite characteristics for pump service.

In connection with the sectionally driven paper machine, motor-driven felt stretchers are used. Each felt stretcher is driven by a constant-speed squirrel-cage motor coupled directly to the intake shaft. A reversing type of push-button-operated magnetic control is used, together with limit switches to prevent the driving mechanism from jamming.

It is reported that for cost of making steam, consumption of steam for drying per unit of production, consumption of steam for cooking sulphite, and labor costs, the plant of the Washington Pulp & Paper Company is one of the lowest newsprint mills on the North American continent. The mill was laid out and constructed and all the machinery selected and installed under the personal supervision of V. D. Simons, consulting engineer, of Chicago. Management and operation of the plant is in the hands of Norman B. Gibbs, mill manager, and Edward H. Vicary, chief engineer.

Revenue and Output Above Estimated Normal

FOR the first time since the opening of the year the gross revenue of the central-station companies was above the estimated normal during September. The gross revenue from the sale of energy during September was $117,200,000, which was 13.7 per cent above the revenue reported for September of last year. This


A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – by Months
C – Average Daily Gross Revenue – by Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917
1918
1919
1920
1921
1922
1923
1924
1925

CENTRAL-STATION OPERATIONS ABOVE ESTIMATED NORMAL DURING SEPTEMBER

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
July	4,966,266	4,255,763	16.5	4,009,266	3,434,763	1,079,000	1,008,000	2,384,266	1,899,763	546,000	527,000	957,000	821,000	778,000	668,000
Aug.	4,998,242	4,382,147	13.9	4,033,242	3,535,147	1,123,000	1,050,000	2,364,242	1,958,147	546,000	527,000	965,000	847,000	785,000	666,000
Sept.	5,020,756	4,457,424	12.5	4,053,156	3,597,424	1,102,000	1,030,000	2,423,156	2,057,424	528,000	510,000	967,600	860,000	809,000	635,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1925	1924	1925	1924	1925	1924
July	52.7	53.4	26.8	27.8	54.1	46.0
Aug.	51.2	54.8	31.4	33.0	51.1	45.0
Sept.	51.6	51.7	27.4	26.9	46.3	50.2

revenue was 1.3 per cent above the estimated normal for the month, this normal being based upon the operations of the industry during the past five years. The reports for the first nine months of the year indicate that the gross revenue for 1925 will total approximately $1,470,000,000, against $1,354,570,000 for 1924.

The energy generated by the central-station companies during September totaled 5,020,756,000 kw.-hr., or at the average daily rate of 167,300,000 kw.-hr., a record figure. The September output was 12.5 per cent above the output reported for September of last year and 2.5 per cent above the estimated normal for the month. In January the operations were only 6.8 per cent over those of 1924, but this percentage gain increased month by month, reaching the high point in July with an output of 16.5 per cent over last year. The output reported for the first nine months of the year indicates that the output during 1925 will total approximately 59,500,000,000 kw.-hr., against 54,413,403,000 kw.-hr. during 1924.

A very material gain in the energy consumption by power customers was reported during September. In September of last year a total of 2,057,424,000 kw.-hr. was sold to power customers, but last September this figure had advanced by 18 per cent, or to 2,423,156,000 kw.-hr. American industry is now using more electrical energy by far than ever before. This is, of course, a reflection of the prosperous condition of industry as a whole.

Thermal Expansion of Tungsten

THE thermal expansion of tungsten is only about one-third that of iron or ordinary steel for temperature ranges between room temperature and 900 deg. F., according to results obtained by the Bureau of Standards in an investigation of the thermal expansion of tungsten. This work was undertaken because tungsten is being used in the steel, electrical, dye, ceramic and chemical industries and in the construction of electric lamps, radio and X-ray tubes. Its physical and chemical properties make it an important metal in the metallurgical world. The investigation covered the thermal expansion of tungsten over various temperature ranges from about —150 deg. to 950 deg. F.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
July	$108,900	$95,400	14.1	71,340	65,300	27,450	20,700	4,130	4,100	5,980	5,300	52,700	48,300
Aug.	111,500	95,800	16.4	74,170	65,300	27,200	21,500	4,120	4,020	6,010	4,980	53,500	49,300
Sept.	117,200	103,000	13.7	77,030	69,230	29,400	24,300	4,330	4,220	6,440	5,250	55,900	51,100

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES||
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Short Tons	1924 Short Tons	Per Cent Increase	1925 Barrels	1924 Barrels	Per Cent Increase	1925 Thousands of Cubic Feet	1924 Thousands of Cubic Feet	Per Cent Increase
July	1,835,021	1,579,633	16.2	3,131,245	2,676,130	17.0	2,771,100	2,403,265	19.4	814,718	1,370,199	—40.4	4,180,741	4,959,046	—15.6
Aug.	1,694,417	1,492,695	13.5	3,303,825	2,889,452	14.3	2,944,496	2,636,433	11.7	720,694	1,457,530	—50.6	4,801,121	5,282,281	— 9.2
Sept.	1,554,865	1,472,370	5.7	3,465,891	2,985,054	16.2	3,029,167	2,639,901	14.6	806,459	1,351,305	—40.3	5,043,445	5,789,847	—188.

|| As collected by United States Geological Survey. The data are for the electric light and power industry only.

Alabama Power's New Office Building

All Departments Housed in Modern Utility Office Structure—Details of Design to Meet Duty Requirements—New Ideas in Arrangements, Wiring and Illumination

By S. NESSELROTH
Architect, Birmingham, Ala.

THE achievements of the Alabama Power Company in the electrical field are well known; evidence to that effect may be found in the award of the Forbes Magazine Public Service Corporation prize to this company in 1925. This award is made to the public utilities company rendering the best service to the community.

In line with its policy and the advancement of its future program toward greater expansion and even better service to the public, the Alabama Power Company is now erecting a new building for its offices in Birmingham, Ala., which is as much of a progressive step in building design and construction as is the company's work in the field of power and light.

NEW HEADQUARTERS OF THE ALABAMA POWER COMPANY

Comparatively few buildings in this country are designed especially to house the offices of a public service company. Some of the most noteworthy examples to be found are those of the Brooklyn Edison Company, the San Joaquin Power Company and the Pacific Gas & Electric Company. Naturally the requirements are different from those in the typical office building.

The new building of the Alabama Power Company was designed to house the various departments that compose the administrative organization. Preliminary studies of other buildings of a similar nature were made by the officers and the architects, and the qualities deemed best in their judgment were incorporated.

Questionnaires were sent to each department head to determine the individual condition as it existed, and estimates were made for immediate expansion and for future expansion. As a result it was determined to lay out the different floors for immediate expansion in each department and two floors in the building were allotted to future expansion. These will be rented to others until such time as the space will be required.

The building has a frontage of 62 ft. on Eighteenth Street and of 140 ft. on Sixth Avenue, and is sixteen stories high. There are entrances on both thoroughfares, connected on the interior with lobbies, one main lobby running through the center from Eighteenth Street to the elevator lobby leading from the Sixth Avenue entrance. There are four high-speed elevators.

The first floor is occupied by the investment department, with its bank-like interior treatment, and the Western division. Both of these departments were placed on the ground floor because of their direct contact with the public. The company doctors' offices, the purchasing department, the traffic department and the safety and employment departments were placed on the second floor. The third and fourth floors are designed for typical offices, which will be rented for the present. The construction department is on the fifth floor; the engineering department is on the sixth floor and part of the seventh floor; the operating department occupies the remainder of the seventh floor; the accounting department is placed on the eighth floor; the ninth floor is occupied by various smaller departments, including the payroll division and the statistical department; the commercial department and general executive offices are located on the tenth floor; the president's offices, executive offices, company secretary, directors' room and the land department occupy the eleventh floor; the legal department is placed on the twelfth floor; on the thirteenth floor there is located the publicity department, men's room, women's rest room and auditorium. The audiorium has a seating capacity of about 500 and is designed to be used jointly as a cafeteria. The blueprint room, photographic department and kitchens are located on the fourteenth floor; the fifteenth floor contains the storage rooms and machine room; the elevator machines are placed on the sixteenth floor. There is a fireproof vault of generous size on each floor from the second to twelfth inclusive. Distributed throughout the building are various accessories for the convenience of the employees, such as ice water drinking fountains, coat rooms, modern toilet conveniences, etc.

One of the difficult problems was the design of an illuminating system that would not only meet the requirements of the individual departments but would

serve also to set an example of good lighting for the community. Several different types of lighting fixtures were selected, with particular attention paid to the engineering and accounting departments, where a semi-indirect system was considered desirable.

ARCHITECTURE OF AMERICAN STYLE

Architecturally the building is of modern American design unhampered by the restrictions demanded by any of the period styles, nevertheless incorporating a little of the influence of several periods, which when combined go to make up what the writer has pleased to call "American."

The building is monumental and massive in appearance, having a main mass carried up to the thirteenth floor composed of solid pylons at the four corners flanking the main façades; these pylons are carried up to and form small balconies at the twelfth floor. Each façade has a series of pilasters bearing on the base, which is leveled off at the third floor; these pilasters continue upward in unbroken lines and terminate in a deep frieze that forms a parapet wall at the balconies at the thirteenth floor. Here the building sets back about 10 ft. on three sides and forms a superstructure two stories high at the rear, giving the additional height to the auditorium. The superstructure is covered with a hip roof that is carried back to the rear elevator pent house, against which the roof abuts. The roof space contains the house tanks and storage rooms.

The detail of the design is quite simple, there being no cornices or projecting sill or belt courses. All the ornament is concentrated at the entrances, and a little is used to form the embellishment of the superstructure. A thing of interest is the detail of the main entrance, which is composed of a monumental portal having stone pylons on either side and joined at the top with a stone frieze containing three carved figures symbolizing "Power," "Light" and "Heat." At the intersection of the roof hips with the main ridge a bronze figure will be placed to symbolize the State of Alabama rising in her electrical progress. The design of the decorative figures is the work of Edward Field Sanford, Jr., of New York, who has successfully adapted his figures to the design of the building. The sculpture has been so well applied that there is no feeling of excessive ornamentation, but a pleasing effect of light and shade.

The building is of fireproof construction. The foundation is formed of cylindrical concrete piers about 6 ft. in diameter bearing on bedrock. The main structure is a steel frame with reinforced-concrete floor slabs of the type known as "pan" construction—that is, sheet steel pans have been used for the forms with concrete ribs 12 in. deep spaced 21 in. on centers. The floor construction is different in that the steel beams at the panel points have been doubled to allow for a depth not greater than the depth of the concrete ribs, which permits of a perfectly smooth ceiling treatment with no projecting beams below. This treatment is desirable for better illumination, as there are no ceiling beams to interfere with the lighting and therefore no cross-ceiling shadows. This type of construction has been found to be more economical than the old method.

The walls are of granite at the base about 7 ft. high and Alabama limestone above up to the third floor windowsills; the walls above are of a light buff iron spot brick with Alabama limestone sills and trim. The exterior face is backed up with hollow tile. All windows throughout are of steel sash, and an unusual effect was produced by the use of steel sash. In order to accentuate the verticality of the building steel sashes were placed at the floor spandrels between the pilasters of the Sixth Avenue and Eighteenth Street façades. This results in giving the appearance of additional height. These spandrel sashes are placed in the same plane as the windows above and below and are glazed with black glass. The effect is that of a tall, continuous window from the third to the eighteenth floor.

The interior partitions are of hollow tile throughout. The doors and trim in the stair shafts and the wire and telephone shafts are of metal. The first-floor lobby is finished with Alabama marble and limestone and a decorative plaster ceiling of deep coffers with gilded sunbursts in the center of the panels. The floors in the offices are covered with battleship linoleum and the corridors with rubber tile, all bordered with sanitary cove rubber bases.

At night the building will be illuminated with a complete flood-lighting system. There will be banks of units placed on adjoining buildings for general illumination. Behind the parapet walls of the balconies at the twelfth and thirteenth floors and at the eaves of the main roof there will be a series of projectors that will illuminate the entire superstructure. At four points of the main roof there will be a group of projectors that will illuminate the bronze figure. As the bronze figure is to be covered with gold leaf, the resulting effect will be startling.

Europe's Largest Three-Phase Generator

THE new generator built by the Siemens-Schuckert Works for one of the large Rhenish-Westphalian generating stations in Germany is by far the largest three-phase generator so far in operation in Europe. It is coupled to a steam turbine of 80,000 hp., operating at 1,000 r.p.m., the electrical output of the generator being 60,000 kw., three-phase, at 7,000 volts. The machine is composed of twenty-six rotor disks about 2.3 m. in external diameter, mounted on a continuous shaft 1.1 m. in maximum diameter, 8.7 m. in total length and 79,300 lb. in weight, the total weight of the rotor disks alone being about 132,200 lb.

Special arrangements were necessary for providing the required ventilating sections in the rotor, which is self-ventilating by continuous coils acting as ventilating vanes, the air passing through milled slots in the shaft and entering the interstices between the various rotor disks. Steel sliprings for the exciter current (of about 1,000 amp.) are fitted on both sides of the rotor. The total weight of the rotor is about 230,000 lb. The shaft is rigidly connected to the turbine by a forged-on clutch and comprises a continuous bore, 300 mm. in diameter, which considerably reduces the weight of the rotor. Approximately twenty-five minutes is required for raising the rotor to 1,000 r.p.m.

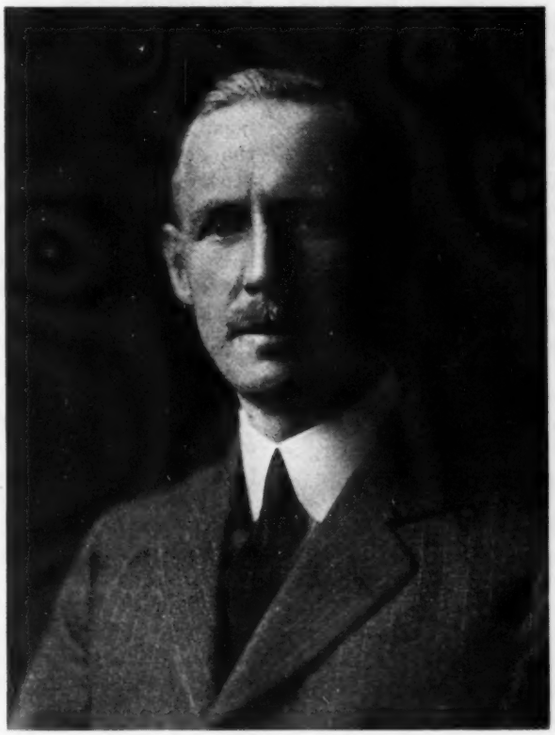
The active iron of the stator is made up of alloyed sheets and weighs 139,000 lb. A cast-iron case, about 99,200 lb. in weight, was required to accommodate the laminated structure, which is 3.5 m. in external diameter. In order to facilitate railway transport the stator was made in four sections. Forty-five cubic meters of fresh air per second are required for cooling the stator, the cooling air entering the laminations axially through about 400 holes, flowing through the radial slot and being discharged across the back of the laminations toward the lower exhaust air tube of the case.

Jobbers' Future Position and Relation with Power Companies*

An Analysis of Present Practices and Tendencies in Central-Station Merchandising—Results Have Benefited All Electrical Dealers—Importance of Jobbers' Service in Carrying Stocks

By R. F. PACK
First Vice-President National Electric Light Association,
Vice-President and General Manager Northern States Power Company, Minneapolis

DISCUSSION of the probable future position and relation of electrical jobbers with the generating companies suggests that there are those in the industry who think that a possible menace exists. Personally, I do not believe that this is the situation. Rather, I feel that the time has arrived when we should sit down together around a table, discuss our common interests and endeavor to find a basis upon which we can continue to do business to our mutual advantage.



R. F. PACK

It is always possible to find extreme views regarding any question, and I presume that this is no exception. Indeed, rumors have reached me that some of the jobbers feel that unless certain of the electric service companies abandon their present practices, or at least tendencies in merchandising it may be necessary to apply to the state legislature to restrict the service companies to the sale of electrical energy only and forbid them to engage in the merchandising of electrical appliances.

So far as the electric utility business is concerned this suggestion does not particularly concern me, for it is my offhand belief that even if such legislation were obtained, it would very likely react against its advocates. We must appreciate that the American public today is analyzing very carefully the processes of distribution of all supplies and is inclined to the belief that great savings can be made by the elimination of the middleman.

ATTEMPTS TO LOWER COST OF DISTRIBUTION

As a result of this mental tendency on the part of the public you can find in any magazine you pick up numerous advertisements carrying such slogans as "Direct from producer to consumer," "From manufacturer to wearer," "Buy direct from the producer and save the middleman's profit," etc. Farmers with this thought in mind have organized co-operative stores and co-operative marketing organizations, and certain manufacturers of silk hose have taken advantage of the situation by sending a considerable army of house-to-house canvassers into the field so that the housewife may buy her silk stockings directly from the producer.

For my purpose it is perhaps sufficient merely to point out that this sentiment exists. To elaborate on it is neither essential nor to the point. Personally these producer-to-consumer advertisements never have appealed to me, and I am quite aware that many of the co-operative marketing and co-operative store organizations have proved failures. The schemes and slogans have a popular appeal with which I am not at all in sympathy. Rather, I am of the conviction that the high state of civilization at which we have arrived requires our somewhat complicated processes of distribution, including the jobber and the retailer, and that this system is better for all concerned than anything else that has thus far been tried. The public, however, is far from convinced that this is so.

Now, let us take a quick review of the past. In the early days of the electric service companies they were compelled to do all the interior wiring, and for a time, as some of you will recall, it was very crudely done. After the business became more stabilized contractors felt safe in investing capital in the wiring business, and the electric companies gradually withdrew from this work until today I doubt if there are any companies left in this country, except in extremely small communities, which are equipped to do interior wiring of any kind.

With the use of electricity for power purposes the companies were again obliged to blaze the trail. As a consequence the central-station organizations stocked

*Abstract of an address presented at the annual winter meeting of the Electrical Supply Jobbers' Association at Buffalo, November 16-20, 1925.

and sold electric motors, for there was no one else willing to make the necessary large capital investment.

At a later date electrical appliances appeared, the first of which I think was the electric flatiron. These devices were often uncertain in their operation and required frequent repairs, which meant that if central stations wished to keep them on their lines, it was necessary to make these repairs at their own expense at a cost which no dealer at that time would naturally be willing to undertake, because the dealer's interest ceased when the appliance was sold by him.

Now we come to the present time, when many of the appliances have become standardized and their upkeep is a more or less negligible item. However, in the meantime such apparatus as electric ranges and refrigerators have made their appearance. These larger users of energy require a heavier capital outlay for stock, and there is considerable servicing expense, in their initial stages, after installation.

I have presented this brief review of the advent of wiring, motors and appliances somewhat in moving-picture form. Speaking broadly, the picture indicates that the pioneer work always has been done by the electric service companies because the dealers were not willing to risk the capital and heavy operating costs involved, and that the dealers entered the field only as standardization was accomplished and service charges reduced to a minimum. It is equally evident that the dealers are in no better position today to carry on pioneer work than they were when the first motors were being installed. Therefore, at this point let us agree that the pioneer work always has been, and always must be, done largely by the electric service companies and that the dealers will stock and sell only those energy-using devices which have become standardized.

Two Ways of Merchandising

Now, what about the companies handling standardized appliances? Personally, I think they should do so, but, like everything else, there are two ways of doing it—the right way and the wrong way. The electric service companies, if there are any such, which insist on doing all the merchandising in any community, regardless of the interests of the existing supply houses and retail dealers, are doing it the wrong way and as a consequence will lose the very valuable friendship which can be created by a community of interests among all of us who are engaged in any branch of the electrical industry. This is the ruthless way, an exemplification of the power of might. It is the selfish way, the wrong way, and while it causes injury first to dealer and jobber, ultimately the chickens will come home to roost and the company responsible will suffer.

The other way is the right way, and I am convinced it can be and is being pursued by methods which are not only fair but distinctly helpful. In the first place, the utility companies' prices on appliances should be based on cost plus a reasonable profit, which presumably would be the prices asked by the dealers, provided the prices quoted by the dealers are not manifestly unfair to the public. The utility, too, should use its influence against the sale of flimsy, undependable types of appliances, for such merchandise can only react against the entire business. One inferior piece of equipment which frequently gets out of order casts its reflection on all electrical equipment. Probably the electric service company's greatest field of good is in the general stimulation of the sale and use of electric appliances. The progressive, modern-day electric company is a firm believer in advertising. It is, or should be, a bigger advertiser than any dealer in the community. A considerable portion of the advertising in my own company is devoted to stimulating the sale of electric appliances. While it is true that the company name appears on these advertisements of ranges, household icing machines, flatirons and heaters, or whatever the articles may be, nevertheless I know that this advertising helps every dealer in the city.

Electrical equipment is a great deal like good roads. One good road sells another. The main highway through a county is transformed from a quagmire of mud into a broad, level, graveled highway, and the immediate consequence is that farmers who never have thought of good roads before come hurrying in to the proper authorities to ask that the side roads connecting with the main highway be likewise improved.

Broad Effect of Utility Advertising

In the same manner the advertisement of the utility company resulting in the sale of a washing machine means that the woman next door comes in to see how the new piece of equipment operates and immediately becomes a prospective purchaser. She is just as likely to buy this washing machine from a dealer as from the electric company. In fact, the woman who reads the company's advertisement and as a consequence purchases the washer frequently buys from a dealer. One machine sells another just as one good road sells another. A survey will indicate that where, for instance, one electric range goes into a neighborhood within a comparatively short period there will be a number of ranges in operation. Many dealers, especially the small ones, cannot afford to carry on these advertising campaigns, and I know that extensive advertising of electric appliances by the electric company is a very great boon to all the dealers. If you doubt this, go into some community where the electric service company has been carrying on an extensive advertising campaign in connection with the sale of electric appliances and get the company to abandon entirely its advertising of such equipment for a considerable period and then watch the effect on the sales by dealers in this community.

I also believe that when an electric service company ceases to sell appliances the dealers in that locality do not profit by its course, but, on the contrary, there is a great falling off in total sales. On the other hand, where the central station is actively, but fairly, selling appliances, you will find the dealers most prosperous.

In Minneapolis, which is the headquarters of the company of which I happen to be general manager, I think I am safe in saying that we and the jobbers and dealers operate harmoniously and for the general good of all concerned. We have an electrical league, the membership of which is made up of jobbers, contractors, dealers and electric service company employees. There are frequent meetings of this league and occasional dinners. All branches of the industry are brought into friendly contact with one another. If a jobber or a dealer feels that the company's sales methods are unfair, and if his criticism proves justified, there is a speedy readjustment. On the other hand, we have an occasional complaint to make ourselves. Perhaps a wiring contractor has too zealously created a desire for electric service by an outlying resident whose home can be reached only by a very costly extension of service wires. At these meetings our men get a chance to tell that contractor, in a nice way, that we don't think he is playing the game quite squarely.

We know one another, we like one another, and we are all working toward mutual prosperity. Little difficulties that come up are ironed out. Our men realize that primarily they are in the business of selling electrical energy to the public, and that the thing of first importance is not who sells the appliance or the range, but rather that they should be sold, so that we may add the load to our lines.

We are, first of all, in the business of selling energy, and to us the appliance business only is important in that it adds to the sale of electrical energy. A prospective appliance purchaser visiting our sales room frequently is told that it might be advisable before making a purchase to look over the stock of some of the dealers in town.

Let me emphasize my opinion that these harmonious relations and methods of fair dealing one with the other must be established locally. National organizations may help, but their efforts are futile unless the contact with human beings is established locally.

Effect of Holding Companies Upon Purchasing

I am told that the interconnection of transmission lines of electric service companies and the formation of engineering and management companies operating large groups of electric properties has made you fearful that you may lose the electric service company business because the big holding or management companies will buy in large quantities direct from the manufacturer.

Naturally on this point I cannot speak for the entire electrical industry. Anything I say must be taken merely as my own personal feeling. It is my conviction that the jobber always has been and always will be of great service to the central-station companies. You have saved us from the necessity of carrying large stocks of electrical appliances and apparatus with the resultant tying up of considerable capital investment; you have made it convenient and highly satisfactory for us to obtain quickly from your stocks energy-consuming devices not on our own shelves, and you have yourselves taken the risk of carrying dead stock representing obsolete appliances and equipment. We should not be consulting our own best interests if we took any step to change the existing state of affairs.

From talks I have had with others in my particular branch of the business, I feel safe in assuring you that I am not alone in this opinion. I am not in a position to guarantee, but it is the inalienable right of every man to think for himself, so allow me in closing to prophesy that the holding companies and the development of so-called "superpower" and the continued merchandising of appliances by the electric service companies will not prove in any way a menace to your business, and that our past friendly, and indeed cordial, business relations will continue—probably on a broader and more satisfactory basis than in the past.

Industrial Lighting in Philadelphia

Organization and Training of Twenty-five Lighting Specialists by the Central-Station Company—Participation of Electrical Contractors and Jobbers—Use of Demonstration Room and Trial Installations in Industrial Plants

By M. C. HUSE

Assistant to Vice-President, Commercial Department, Philadelphia Electric Company

IT HAS long been known to the electrical industry that, in industrial plants which have illumination that is below standard, the installation of proper lighting will increase production, decrease spoilage and labor turnover and improve morale, but the difficulty has been that the necessary selling effort to convince the customer of these facts has not been expended.

Lamp companies and reflector manufacturers have made spasmodic efforts to stimulate sales and many central stations have tried to interest their customers by means of lighting service departments, but it must be conceded that the attempts to reach this market have been rather futile when compared to the magnitude of the entire field. There is no doubt that the plant manager can be most quickly reached through the application of the adage that "seeing is believing" and he requires proof definitely made and facts well substantiated. It is for these reasons that the use of test lighting installations has been of tremendous advantage in securing appreciation of the value of higher intensity and improved quality of illumination.

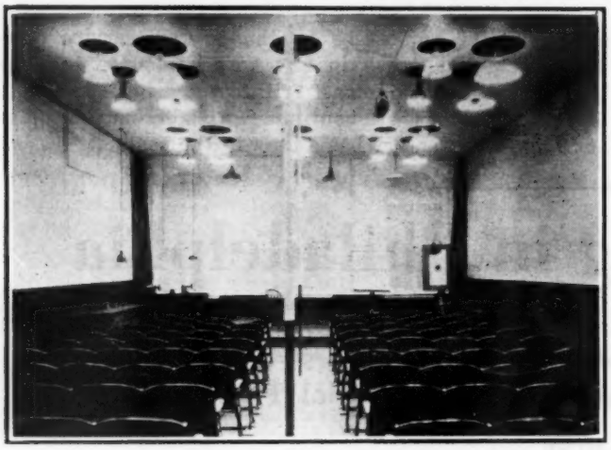
When the industrial lighting campaign was first contemplated, the Philadelphia Electric Company decided upon the intensive use of this method of selling by trial installation, in order to collect accurate data on production increases and also to obtain testimonials that might convince other plant managers of the value of good lighting. It was soon found that plant executives are interested in improving lighting conditions and that they welcome the opportunity of observing the results to be gained through improved lighting equipment and of studying its effect on actual operating conditions.

Test Installations in Twenty-five Plants

In about twenty-five industrial plants a careful study was made to determine the best type of lighting equipment for the particular circumstances, and test equipment was then installed over some group of machines or in some subdivision of the plant. The manager agreed to keep careful production records both before and after the installation of the improved lighting and also, so far as might be possible, to maintain comparative records of spoilage, labor turnover, attitude of employees and machine breakdowns, with the time required for repairs.

To cite an example of the usual method followed, a test system of lighting, covering an area of approximately 625 sq.ft. of floor space, was installed for a manufacturer of infants' hosiery. This particular location was in the basement and received direct lighting through three small windows on one side. As might be expected, dense shadows were created that were exceedingly troublesome to the workers employed in

operating the knitting machines. Nine bare 100-watt lamps were hung at irregular intervals with the light thrown directly in the workers' eyes. The demonstration lighting consisted of 200-watt bowl-enameled lamps in "RLM" domes, spaced on 8-ft. centers, 9 ft. above the working plane. The intensity of the illumination was increased from 6.5 to 16.7 foot-candles, direct glare was entirely eliminated and the shadows were not too dense to be objectionable. Production was increased 10.8 per cent on the knitting machines and 6.1 per cent on the looping machines, the latter already receiving more daylight illumination. The installation cost was 0.4 per cent and the operating cost 1.1 per cent of the annual payroll. Spoilage was greatly decreased, although no exact figures were obtainable; fewer breakdowns of machines were noted, and repairs were made more rapidly than had previously been the case. Perhaps the most startling result of the installation is found in the fact that labor turnover was reduced from 43 per cent per month to almost the vanishing point, with a corresponding improvement in employee morale.



LIGHTING DEMONSTRATION ROOM AT SPRING GARDEN INSTITUTE

Another test was made in a mill manufacturing ladies' silk hosiery. The room was painted white and about 40 per cent of the wall area was window space, which might be expected to give good results for daylight illumination. The lighting installation consisted of a single row of gas-filled lamps with shallow bowl reflectors for each pair of machines. Two trial installations were made, one with four 200-watt lamps in Glassteel diffusers on 8-ft. centers, mounted 8 ft. above the floor and slightly in front of each operator, and a second method using the same installation but with bowl enameled lamps in "RLM" domes. Tests were conducted for three months and showed a consistent increase in production of 14 per cent for the day shift and 16 per cent on the night shift, with practically no variation between the two types of lighting. The intensity of illumination was increased from 7.2 foot-candles in the old installation to 16.5 foot-candles with the Glassteel diffusers and to 21.1 foot-candles with the "RLM" domes.

A rather unusual case was that of a plant which manufactured tape for electrical insulation purposes. These looms have a high projecting shuttle bar over which the operator must bend when tying broken threads. The lighting consisted of two 75-watt bare lamps for each pair of 20-ft. machines. Since artificial lighting is necessary practically all of the time on many of the looms, it was felt that considerable expense was justified to reduce shadows and improve illumination. The existing drop cords were replaced by 200-watt indirect lighting units, which could be used effectively on account of the excellent ceiling conditions. The lighting intensity was increased only from 6.8 to 7.9 foot-candles, but shadows were almost completely eliminated. A six weeks' test showed a consistent increase in production of 5 per cent and further tests have shown increases as high as 13 per cent.

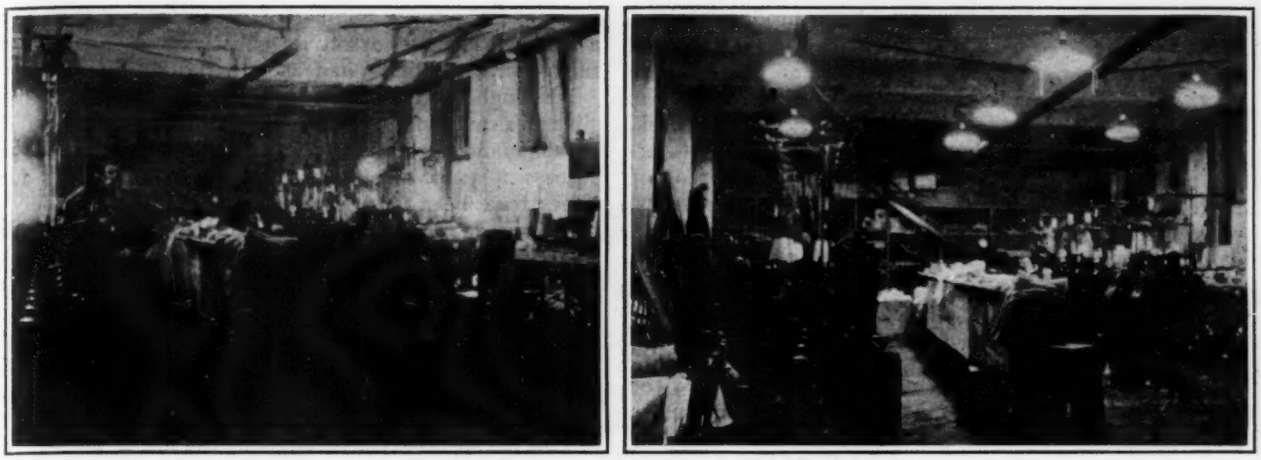
The last two cases noted were examples of the increase in production made possible by improving lighting that was already fairly good. An example of what can be done when poor lighting is encountered was illustrated in the case of a weaving mill manufacturing dress goods. The ceiling was low and the upper space was filled with a maze of overhead shafting and belting. Lighting was obtained from 50-watt lamps hung on drop cords spaced on 7-ft. centers and equipped with an array of antiquated reflectors which usually hung loose without shade holders. The new installation consisted of "RLM" domes equipped with 75-watt bowl-enameled lamps and mounted 7 ft. above the floor. The increase in illumination was from 1.9 foot-candles to 9.8 foot-candles. The production immediately increased by 25 per cent after the installation of the new lighting, and careful tests and records made by a skeptical manager merely confirmed this percentage.

TRAINING LIGHTING SPECIALISTS

Having secured valuable test data from such trial installations, Philadelphia was prepared to join heartily in the national activity of the Industrial Lighting Committee. The first necessity was the training of a number of additional salesmen. For this purpose, twenty-five men were selected from the sales organization of the Philadelphia Electric Company and for a period of three months they were given intensive education and training in industrial lighting under a competent instructor. In the conduct of this class, the men were first drilled in the fundamental principles of illumination as applied to industrial work, the remainder of the training period being consumed in the solution of typical problems encountered in the routine work of the lighting service department. All instruction material, lecture notes and test data were prepared in loose-leaf form so that, at the completion of the course, each salesman had his own handbook of illuminating engineering. During the course the entire class visited the Lighting Institute of the Edison Lamp Works at Harrison, N. J., and received valuable information from this source.

During this period of instruction there was also being prepared a complete record of all the industrial plants in the territory, together with the names of the owners, managers and electrical engineers of such plants. This information was listed on a special card form, which was designed for use as the general follow-up record of the campaign. Ten thousand plants were so listed, including every establishment manufacturing a definite product. Stores were not included unless there was, as a part of the establishment, a shop for manufacturing the articles on sale. Garages were not included unless a repair or machine shop was a part of the equipment.

After the creation of a sales force and a record of prospects, attention was directed toward the organization of the entire electrical industry of the city for



LIGHTING TEST MADE IN HOSIERY KNITTING MILL

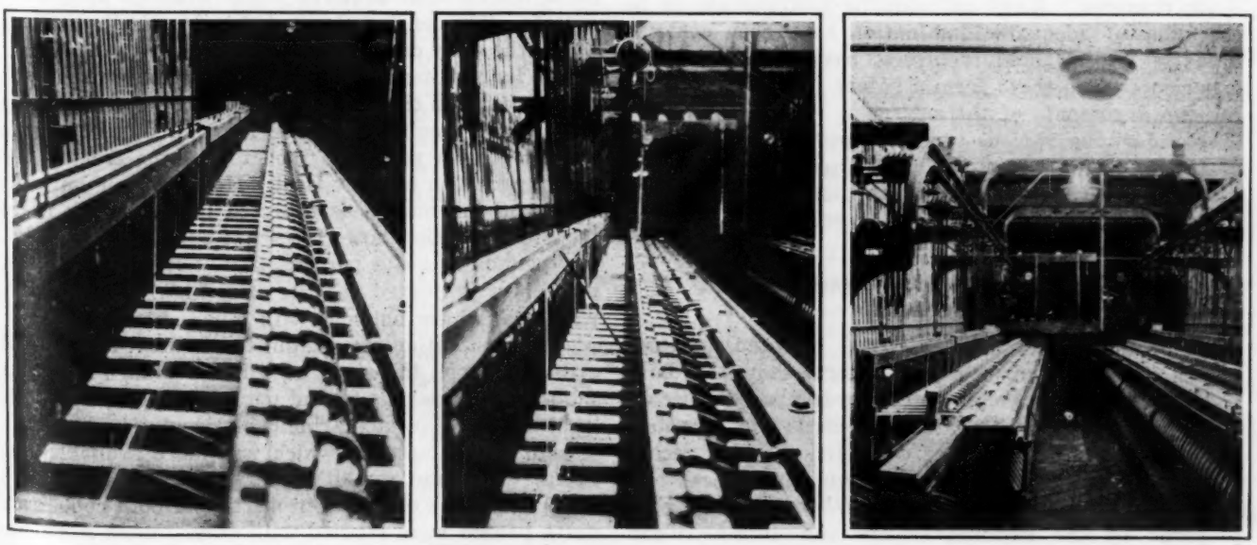
On the left is the obsolete equipment, on the right is the new installation. Average foot-candle intensity: old system, 6; new system, 17. Average increase in production due to better illumination, 6.3 per cent. Labor turnover has been reduced from 43 per cent per month to 0. The increase in annual operating cost due to change in lighting is 1.15 per cent of the annual payroll.

co-ordinated sales effort. The Electric Club of Philadelphia assumed a leading part in the organization of the activity and a plan of operation was jointly prepared by the club and the central-station company. The club agreed to secure the co-operation of the electrical manufacturers, jobbers and contractors and to organize the efforts of these groups as a part of the campaign. It undertook to raise the sum of $7,500 from the trade to defray the cost of the proposed demonstration room, the local advertising and the general organization and miscellaneous expenses.

The utility agreed to furnish for the campaign a complete list of industrial prospects, to conduct a direct mail advertising campaign for this prospect list, to furnish sales engineers to interview prospects and sell the idea of improved industrial lighting and to furnish illuminating engineers for the preparation of plans and specifications.

The plan of operation as agreed upon includes the payment of $50 by each participating contractor and $150 by each jobber. The contractors install, without charge, trial lighting equipment in accordance with the specifications of the lighting engineers and the jobbers loan the necessary reflectors for the purposes of such test installations. The sales work is done by the engineers of the utility loaned to the Industrial Lighting Committee for the period of the campaign. As leads are secured by these salesmen in the form of orders for either trial or complete installations, assignments are made to the contractors in accordance with a definite arrangement established by lot. If the prospect desires a particular contractor, this job is assigned in accordance with the prospect's wishes, whether or not such contractor is participating in the campaign.

After a request for a trial installation has been signed by a customer, an order is issued to a contractor to secure the stated equipment from a certain jobber and also the necessary lamps from the central station, and to make the installation as described in an attached layout. A form is also furnished to the contractor upon which he reports to the committee the completion of his work. The installation is then checked by a competent engineer, who also points out to the customer the advantages of the new lighting. It may be interesting to note that in a majority of the cases the sale of a complete installation is made at this time. The



INSTALLATION OF INDIRECT LIGHTING IN TAPE MILL

Elimination of shadow indicated by arrow increased production 7.7 per cent. General view of new lighting shown on right.

customer is also shown how to keep production and spoilage records so that he is assured of the real value of good lighting. A week later a second call is made by the man who was responsible for the original sale, followed by a final call at the end of the second week. At this time the foot-candle meter and the Bray projector are used in order to offer every possible proof of the efficiency of the new equipment. After this interview, unless the sale of a complete or partial installation is effected, the contractor is ordered to remove the trial equipment.

EQUIPMENT OF DEMONSTRATION ROOM

The construction of the demonstration room was made possible through the generous co-operation of the Spring Garden Institute in permanently assigning a large recitation room for the use of the exhibit. This room, built at a cost of approximately $4,000, has been considered by competent judges to be second to none in the country. Furthermore, its central location makes it of especial value. It was found that the best time for securing the attendance of factory executives at the demonstration room was from 4 to 6 o'clock in the afternoon. Accordingly, tickets have been prepared which are distributed by the salesmen admitting the bearer to the exhibition at these hours on Tuesdays and Thursdays. The demonstration is conducted at other times only by appointment. Any one of the salesmen can deliver the lecture and conduct the demonstration, so that full use can be made of this sales medium.

In order to insure united action, considerable effort was expended during the early part of the campaign in selling the idea to all members of the electrical trade. Meetings were held at the demonstration room for all manufacturers' and jobbers' organizations and for groups of contractors. Furthermore, frequent letters are issued to those participating in the campaign, so that they may be familiar with all developments and so that their interest may be well sustained.

In order somewhat to standardize the work of the salesmen, a "sales manual" was prepared which included "before and after" views of several representative Philadelphia plants and the actual results of tests made in Philadelphia which show startling increases in production, together with decreases in spoilage and in labor turnover. Many enthusiastic testimonials as to the value of adequate illumination have been contributed by leading manufacturers, based on their own experiences, and these form a potent factor in supporting the arguments of the salesmen. A sales talk was prepared giving various types of approach, sales arguments and answers to objections. Three Bray machines and four foot-candle meters are in constant use, helping the salesman to convince the prospect of the value of good lighting.

EARLY RESULTS INDICATE LARGE VOLUME OF BUSINESS

All of the sales stimulants usual in intensive campaigns are employed. Progress charts show the daily and the cumulative volume of sales, compared with an established bogey. Comparative records for all salesmen encourage the spirit of competition. Full recognition is given to outstanding accomplishment.

Use has been made of the play "What Price Light" prepared by the national lecture and demonstration committee. This play, somewhat modified and rewritten, is being effectively produced by two competent casts and the large number of presentations that have already been made attest its effectiveness as a part of the general publicity and sales activity.

Although the campaign is too young to make it possible to draw definite conclusions as to the limits of its development, some statements can be made as to the success already attained. Forty installations in factories have been made in one week, and undoubtedly a minimum of one hundred installations will soon be established. The results obtained by these sales may be further analyzed and separated into four classifications. In 60 per cent of the cases specifications are prepared and the sales made on the basis of a complete installation for the lighting of the whole plant. In 25 per cent of the cases a trial installation is made which is sufficiently convincing to induce the executive to extend the installation throughout the major part of his plant. In 10 per cent of the cases the executive is unwilling to adopt the higher intensity of the test installation for general use, but desires to purchase the lighting equipment which has already been installed. In the remaining 5 per cent the test equipment is ordered out, usually on account of the cost involved in a complete installation or on account of the temporary nature of the occupancy of the building.

Apparently little effect can be traced to the national advertising or to the three broadsides which have been mailed to the entire prospect list. Direct sales effort by competent lighting engineers is required if the industrial lighting market is to be reached. There is no question that this market is of tremendous size and of vital importance, but all branches of the electrical industry must be willing to expend the necessary sales effort with a trained and competent personnel if success is to be assured.

Insulation for Submarine Cables

THE use of submarine cables is increasing and new cables are being laid all the time, says the Bureau of Standards of the Commerce Department in announcing the results of a study of material suitable for cable insulation. The cable which stretches under the seas consists of copper wire insulated with gutta percha and protected by steel armored wires wrapped around the outside. The construction today is practically the same as for the early cables.

The largest item in the cost of manufacturing a submarine cable is the cost of gutta percha for the insulation, which amounts to more than all other items together. Gutta percha is the gum of the tropical tree which grows in the Far East. Most of the gum which comes on the market is collected in forests by native methods in which large trees are cut down for only a few pounds of gutta percha. It is not surprising that the supply is limited and the price high. Gutta-percha plantations have not met with much success.

An investigation carried out by the Bureau of Standards undertook the study of gutta percha, rubber and rubber-like materials to find out what material was the most suitable for submarine cable insulation. The aim was to find a material which was more available than gutta percha and would yet serve the purpose as well. Accordingly the electrical properties of both rubber and gutta percha were studied with care. Much work was done on rubber, because rubber, as used in the arts, is not a simple substance, but is really a mixture of

vulcanized India rubber with a variety of inert materials called fillers. Electrical insulation such as is used in house wiring may contain only 20 or 30 per cent of rubber. The materials which are added to rubber are by no means to be considered as adulterants. They modify the properties of the rubber to suit the use.

In order to find out the kind of rubber insulation which would be most suitable for use in making a submarine cable, it was necessary to study the effect that a great many materials had on the electrical properties of rubber. Because the investigation covered rubber in so many combinations, the results will be of use wherever rubber is employed for insulation. Many of the combinations of rubber which were studied and found to have electrical properties totally unsuited for submarine cables may have just the characteristics needed for some other purpose.

The conclusion was reached that rubber insulation may be made which has the properties needed for submarine cable insulation, in some respects being superior to gutta percha.

Letters from Our Readers

Major Tyler's Conclusions on Wilson Dam Questioned

To the Editor of the ELECTRICAL WORLD:

In your issue of October 10 Major M. C. Tyler gives some interesting statistics on power costs at Wilson Dam. However, if I correctly understand his figures, they do not bear out his conclusion as to the value of Dam No. 2. Major Tyler's argument seems to be that if an equivalent steam plant costing $5,600,000 can produce power for 0.6 cent per kilowatt-hour and Dam No. 2 can produce power at 0.52 cent per kilowatt-hour with an output of 400,000,000 kw.-hr. per year, and the hydro-electric plant thus shows a saving of 0.08 cent per kilowatt-hour, or $320,000 per annum, then this saving capitalized at 4 per cent makes the hydro-electric plant worth $8,000,000 more than the steam plant, or $13,600,000.

Following this reasoning, if the production cost were the same in the two stations, Dam No. 2 would be worth only the cost of the equivalent steam plant, or $5,600,000. In other words, it is held that although a hydro-electric plant costing $36,199,162 can compete on even terms or better with a steam plant costing only $5,600,000 while both pay interest and sinking-fund charges on the full investment, the hydro plant must be considered to be worth much less than the original investment.

The fallacy of such an argument would have been apparent to Major Tyler had he attempted to work out the annual costs of the hydro plant using as the basic value on which to figure interest and sinking fund the sum of $13,600,000 which he sets up as the value of Dam No. 2. The fixed charges on the steam station are small while fuel and other operating costs are large. Consequently a hydro plant earning the same amount but requiring no fuel and with very small operating expenses can pay fixed charges on a much larger investment. Therefore the hydro plant justifies the expenditure of more money for construction and is worth more than a steam plant, even though costs per kilowatt-hour may be the same.

In this case, using Major Tyler's cost figures and capitalizing the lower cost of power produced by Dam No. 2, this hydro-electric development, producing 400,000,000 kw.-hr. per annum, will earn 4 per cent interest and a sinking fund on $36,199,162 plus $8,000,000, or a total of $44,199,162, and at this valuation is as much justified as his steam plant costing $5,600,000, provided the output of each can be sold at 0.6 cent per kilowatt-hour.

Similarly, if Dam No. 2 and Nitrate Plant No. 2 steam station are operated together to produce 860,000,000 kw.-hr. per annum at 0.34 cent per kilowatt-hour instead of 0.6 cent, which would be the cost in a straight steam plant, then the capital saving should be added to the combined cost of Dam. No. 2 and Nitrate Plant No. 2 steam station rather than to the cost of an equivalent steam plant.

Taking Major Tyler's cost figures as published in his article, we have:

Power investment, Dam No. 2	$36,199,162
Nitrate Plant No. 2 steam station	6,000,000
Annual saving of $2,236,000 capitalized at 4 per cent	55,900,000
Earning value compared with $11,200,000 steam station	$98,099,162

As Major Tyler points out, 4 per cent is a low interest rate. As the rate increases the comparative investment on which the hydro plant will earn a return decreases.

There may be still other factors which should be considered, but certainly when properly interpreted Major Tyler's figures leave Uncle Sam with an encouraging margin of value in his Muscle Shoals venture.

BARRY DIBBLE,
Consulting Engineer.

Redlands, Cal.

An Appeal for the Trees

To the Editor of the ELECTRICAL WORLD:

May I comment on your timely and interesting editorial on "Trimming Shade Trees" in the ELECTRICAL WORLD for November 7? Having had some experience myself in the matter of the unnecessary carelessness and lack of appreciation sometimes displayed in the trimming of trees, I feel that your comment on this subject is appropriate and should do much to abate this evil.

If those who are responsible would have in mind the lovely poem of Joyce Kilmer, who fell with the American Expeditionary Forces in France in the World War, I am sure the inspiration of its noble sentiment would bring them to pause before undertaking to destroy one of Mother Nature's most reverenced and beautiful monuments.

The poem follows:

I think that I shall never see
A poem lovely as a tree—
A tree whose hungry mouth is pressed
Against the earth's sweet flowing breast;
A tree that looks at God all day
And lifts her leafy arms to pray;
A tree that may in summer wear
A nest of robins in her hair;
Upon whose bosom snow has lain,
Who intimately lives with rain.
Poems are made by fools like me,
But only God can make a tree.

FRANK W. SMITH.

United Electric Light & Power Company,
New York, N. Y.

Central Station and Industrial Practice

Distribution Losses Reduced by Line Surveys

BY EUGENE VINET
Middle West Utilities Company

THERE seems to be a tendency to underestimate the economies that can be effected in building distribution systems having the least energy or "unaccounted-for" loss between the station busbars and the consumers. Generation and transmission of energy, although very important, are no more so than distribution, the channel through which the energy reaches the consumer.

A few years ago it was taken as a matter of course that distribution losses could be expected to be in the neighborhood of 20 to 30 per cent. With greater use of apparatus affording better efficiencies and greatly improved load factors, it is a frequent occurrence to find distribution systems with only 10 to 15 per cent of "unaccounted-for" energy between busbars and consumers. This change has occurred not only in large cities where high load factors are obtainable but also in small towns varying in population from 2,000 to 15,000 or thereabout.

Based on records from an organization that serves more than 1,500 cities and towns, forty-five towns picked at random have losses of less than 15 per cent. Many others have similar conditions. The conditions on these lines are indicated in an accompanying table showing population, average kilowatt-hours consumed per month over a period of six months, and the average percentage loss. The record is a striking example of what can be done toward securing greater efficiencies in other small towns. Such results have been obtained by consistent surveys to eliminate all low voltages at the consumer's premises and the reduction of distribution transformers to such a point that overloads are carried on every transformer at some time or other during the year for short periods of time.

It is too often overlooked that the cost of the energy generated goes up very appreciably with increase in losses. A 10 per cent loss means an increase of approximately 12 per cent in the cost of the energy, taking into account fixed charges on equipment and those which would obtain if there were no losses at all. A 20 per cent loss increases the cost of energy by approximately 25 per cent, and a 30 per cent loss increases the cost of energy by approximately 40 per cent. When considering the enormous possibilities for the saving of energy and therefore money that can be obtained by greater efficiency in distribution work, it seems that the distribution engineers or those engaged in distribution work are too prone to take as a matter of course that it is quite proper to lose approximately one-fifth or one-quarter of the energy generated before it reaches the consumer.

In practically every field of activity that goes to make an electrical system tremendous strides have been made in the last few years. The consumption of coal per kilowatt-hour has been considerably reduced; efficiency of waterwheels has reached very high figures; generators, transformers and electrical apparatus of all sorts have also made considerable progress in efficiencies; transmission lines are now designed to operate with average energy losses of 5 per cent or better. In spite of all these improvements, the average distribution system, particularly in smaller cities and towns, still lags far behind what should be the standard for operation. This condition exists to a very large extent because of the lack of conception and realization on the part of executives and those in charge of distribution systems of the actual possibilities and advantages of greater efficiencies in distribution work. What is the use for designers of machinery and apparatus to strain every ounce of ingenuity and endeavor to increase their efficiencies to meet the requirements of the purchasers until the highest fractions are obtained, if all those gains and improvements are to be lost and wasted by careless distribution work?

There is still too much restraint on the part of some executives when it comes to spending money for purposes of surveys and research for improvements to distribution work. Although many engineers responsible for this work would be prepared and are anxious to conduct extensive improvements and experiments in this field, unfortunately they very often do not receive proper support from the executives, with the consequence that no progress is made. All such work in order to be successful must necessarily start at the top.

UNACCOUNTED-FOR LOSSES IN REPRESENTATIVE TOWNS WITH LESS THAN 15,000 POPULATION

Town No.	Population, 1920 Census	Average Kw.-Hr. Used per Month	Per Cent Loss (Period 1/1/25 to 6/30/25 Inclusive)
1	375	7,000	15.0
2	344	3,000	11.2
3	7,201	230,000	13.2
4	2,716	108,000	13.3
5	456	4,000	12.1
6	2,129	47,000	14.4
7	1,387	34,000	8.8
8	541	7,000	13.8
9	2,000	14,266	13.9
10	5,000	55,952	11.5
11	8,865	275,000	9.6
12	1,222	30,000	14.4
13	1,448	50,000	14.0
14	2,279	29,000	11.1
15	530	8,000	13.4
16	3,500	32,733	14.8
17	9,852	212,000	9.8
18	6,714	169,000	9.3
19	13,552	440,000	10.7
20	540	8,000	9.9
21	1,466	28,000	9.7
22	1,017	4,000	12.8
23	1,149	20,000	11.8
24	3,465	42,000	14.7
25	1,337	9,000	12.7
26	1,182	27,000	10.6
27	1,800	27,521	13.1
28	5,806	194,000	10.8
29	1,078	11,000	8.9
30	1,540	28,000	14.2
31	645	5,000	14.3
32	4,299	178,245	11.3
33	11,595	1,222,683	11.0
34	8,990	286,168	14.1
35	9,901	976,568	14.4
36	1,785	25,837	8.0
37	4,900	208,266	10.4
38	763	154,755	9.1
39	1,907	55,386	10.4
40	10,098	370,730	12.0
41	14,458	145,710	7.4
42	7,348	176,450	12.6
43	9,701	343,775	12.9
44	379	4,228	14.0
45	1,357	39,591	11.0

New Process of Calking Furnace Electrodes

THE Metallbank & Metallurgische Gesellschaft of Frankfort-on-Main has worked out a new process of calking the electrodes of electric furnaces, which is described by the American Consul-General at Frankfort.

The electrodes are brought through openings in the furnace walls or vaults, and at the point of entry materials are introduced such as tar, pitch, tar oil and other similar products which, at the existing temperature, form a liquid mass, fill the narrow opening around the elec-

trodes and prevent the exit of furnace gases and flames.

The process is characterized (1) by choosing such calking materials as will form a crust or coke residue between the electrodes and the opening; (2) by surrounding the electrodes at the opening with a cooling ring, which prevents too strong a formation of coke and too strong a disintegration of the calking materials; (3) by introducing the calking materials in a non-liquid state into the entry which is to be calked, at which point they are liquefied by the existing temperature; (4) by conducting the distillation products, which are forced out of the electrode mass burned in the electric furnace itself, to the opening, where they act as a calk.

This process, on which a patent has been taken out, is said to prevent the furnace flames from injuring the electrodes by flaring through the opening used for them.

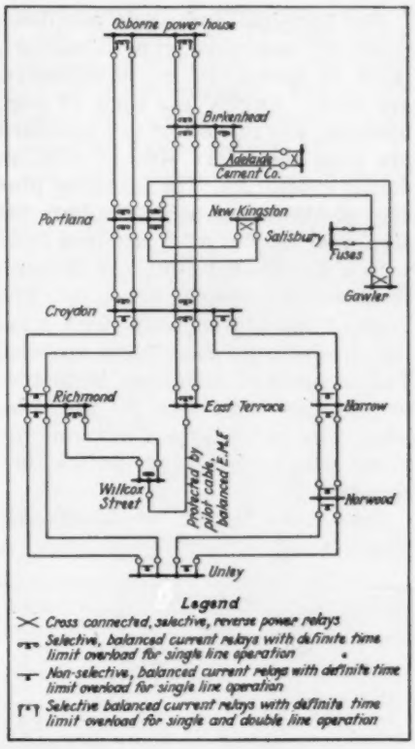
Transmission Practice in Australia

By F. W. H. Wheadon
Engineer and Manager Adelaide Electric Supply Company, Ltd., Adelaide, Australia

ALL power from the Osborne station of the Adelaide Electric Supply Company is transmitted at 33,000 volts to ten main transformer substations, situated at strategic points in the system, by two double-circuit transmission lines carried on a 50-ft. wood pole line. The poles are spaced 250 ft. apart. The conductors used are copper near the seacoast, and aluminum steel reinforced further inland, the latter having a conductivity equivalent to 0.15 sq.in. of copper. Pin type insulators are used, having a dry flashover test voltage of 110,000, and wet flashover of 75,000 volts. For the lines near the seacoast larger insulators having a flashover of 145,000 volts dry and 90,000 volts wet are installed. During twelve months operation no trouble has been experienced on the line from flashovers or burnt crossarms, except in one substation located near a cement and chemical works, where salt and cement dust deposited on the insulators, which in this case were mounted on earthed metal crossarms.

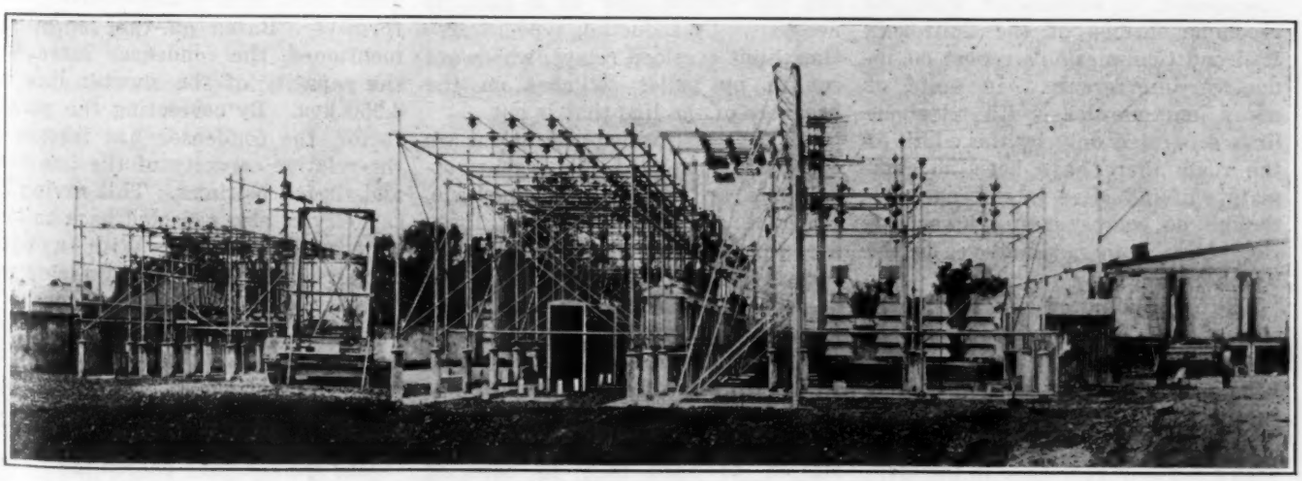
The transmission lines deliver to a ring main, junctioning with it at Croydon, three miles from the city. Each substation on the ring is supplied by two double-circuit lines, the two circuits of each line being operated as a balanced pair for protective purposes. Each circuit, however, has its own oil switch, so that in the event of a fault on one circuit, the other can be put back into service with but slight delay. The transmission line between Osborne and Croydon and around the ring are carried along the public roadways, the ring having an average radius of three miles from the city.

Transmission line poles also support the 7,600-volt primary distribution and 440-volt secondary distribution lines. In these cases shorter intermediate poles are placed between the 50-ft. poles to halve the span. The spacing of the conductors on the 33,000-volt circuits is 36 in. and they are arranged on an equilateral triangle, with the apex at the bottom as shown herewith. This gives freer access for line construction and maintenance purposes. Steel towers are used only at terminals and angles where space permits.



RING TRANSMISSION SYSTEM BEING USED IN AUSTRALIA

The 50-ft. poles are sunk 7 ft. in the ground, and are erected complete with insulators and crossarms by means of a pole-erecting jib mounted on a motor lorry. Their section is 16½ in. diameter 5 ft. from the butt end, and 8½ in. at the top. Although they weigh two tons, they are readily handled by the pole erector and six men. A normal day's work with this gang is from six to eight poles set and erected. The crossarms are 5-in. x 4-in. West Australian karri, double cross-arms being used for special strains.



VIEW OF 33,000/7,600-VOLT CROYDON SUBSTATION

For terminal and angle positions, strain or suspension type insulators, three in series, 10 in. in diameter, are used. Angles less than 10 deg., however, are turned on two standard pin type insulators side by side on double crossarms. The insulator pins are of the company's standard design, and consist of a cast-iron body with a flat-headed ¾-in. bolt through them and through the crossarm. The head of the pin is bound with marlin, on which the insulator is screwed. This method of attaching insulators to pins has been used by the Adelaide Electric Supply Company for many years with most satisfactory results.

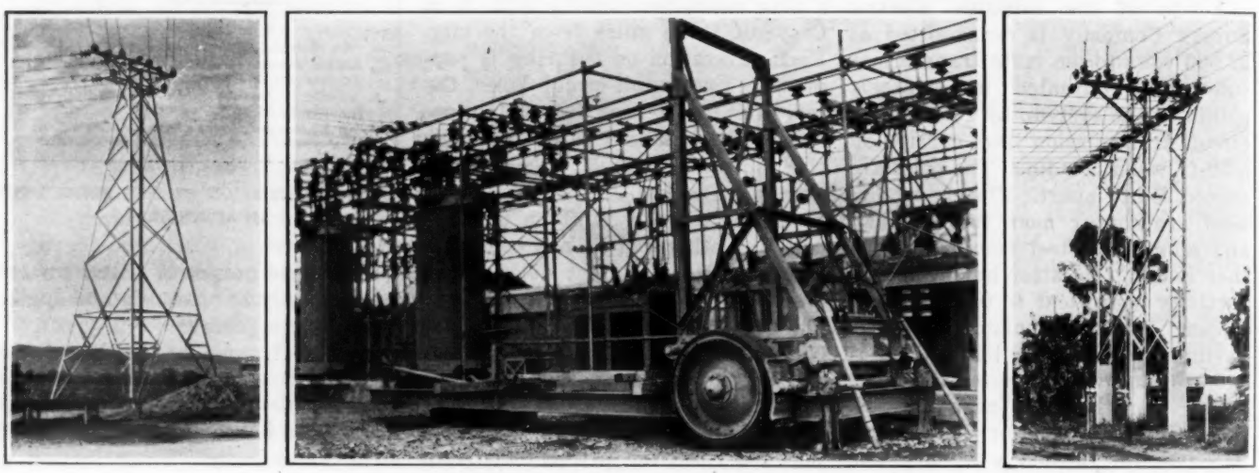
The total length of 33,000-volt lines erected is thirty-seven miles. A further ten miles is under construction, and orders have been placed for materials for another fifty miles extension into the agricultural districts to the north of Adelaide.

The 33,000-volt circuits have been transposed in accordance with the recommendations of the California Railroad Commission's report on inductive interference. In spite of many long parallels with telephone lines separated only by the width of the road, there have been no complaints of inductive interference, although no corresponding transpositions have been made as yet in the telephone lines.

The star point of the 33,000-volt side of the step-up transformers at the power station is solidly earthed. All circuit breakers have the same rupturing capacity, being based on the maximum short-circuit current with 8 per cent reactance in the step-up transformers, and 10 per cent in the generators, the reactance of the transmission lines being treated as negligible. Lightning conditions of Adelaide are comparatively mild, and it is not considered necessary for the usual overhead ground wire protection. Oxide film lightning arresters, however, are installed at Osborne and Croydon, but not at any other point on the ring.

The protective relays are of the balanced type, and they act instantaneously to cut out a faulty section of line. On the sections mentioned between Osborne and Croydon they act selectively to switch out only a faulty circuit, but elsewhere non-selective relays trip both circuits of a pair if a fault occurs on one of them. Owing to the use of the ring system such a fault, if limited to one section of the ring only, does not result in interruption to the service, while it gives sufficient protection, and uses the simplest form of relay. Provision is made for operating one circuit only of a pair, if necessary, by induction type inverse time limit overload relays, which are cut in by pallet switches on the breakers of the line that is out.

All the transformer substations are operated unattended. Emergency attendants are available at Adelaide, Croydon, and Port Adelaide; these are sent to the substations to perform switching operations when required. An alarm system is being installed that will give an indication at the East Terrace converter station when any 33,000-volt switches are automatically tripped, so that it will be immediately known to which substation to send men in case of trouble.



VIEWS OF AUSTRALIAN TRANSMISSION LINE CONSTRUCTION

At left, angle tower for 33,000-volt line (note inverted triangle line construction). In center, ruggedly built transporter designed especially for hauling transformers. At right, typical steel structure carrying 33,000-volt lines

Value of Condenser Demonstrated

INSTALLATION of a synchronous condenser at an energy-distributing center and tie point with another system effected some striking benefits for the Public Service Company of Northern Illinois recently. Prior to its use, voltage at this particular distributing center (which was thirty-seven miles from a generating station) could not be maintained at the proper value. Furthermore, the capacity of the shorter of the two lines to this center was limited to 1,900 kva. at 33,000 volts based on a load power factor of 75 per cent and 7 per cent voltage drop.

Correction of the trouble could have been made by adding another transmission line, recoppering the present lines or installing condenser apparatus. However, analysis of the situation dictated a 5,000-kva., 4,000-volt synchronous condenser energized from three water-cooled transformers. Based on the conditions mentioned, the condenser increased the capacity of the shorter line to 4,950 kva. By correcting the power factor, the condenser has increased the relative capacity of the line two and six-tenths times. This saving in capacity is also reflected back to the generating station. With a condenser bringing the power factor up to unity, only 1,900 kva. of generating capacity would be required to supply the load, whereas without the condenser the same load would require 2,550 kva. of generating capacity.

Had the company chosen the alternative of building another line, it

would have been necessary to supplement the present No. 2 copper line with a No. 3/0 line at a total cost of more than four times the cost of the condenser installed. The saving in fixed charges was far more than the cost of operating the condenser. Also, the additional line, although giving adequate transmission capacity, would have required greater generating capacity and would not have given as satisfactory voltage regulation. The condenser, under operating conditions in this particular case, may be considered equivalent to an additional transmission line in carrying capacity, or, in other words, the condenser makes the present line equal to itself plus an additional No. 3/0 line. Should this line be out of service, the condenser would increase the capacity of the other existing line in approximately the same ratio.

Absorption Refrigerator

Domestic Refrigerator Operates on Continuous-Absorption Principle —No Moving Parts Required—Total Pressure in the System Always the Same

AN ELECTRIC refrigerator that dispenses with all moving parts and operates on the continuous-absorption principle has been invented by two young Swedish engineers, B. de Platen and C. Munters. In this refrigerating unit the total pressure is the same everywhere in the whole system of pipes and containers of which it consists. The indispensable drop in pressure of the cooling agent (ammonia) when entering the evaporator is obtained by introducing there an inert gas, such as hydrogen. (See Dalton's law of partial pressures.) The presence of this gas produces a drop in the vapor pressure of the refrigerating agent, because as the gases mix the partial pressure of the refrigerating agent falls and the process of evaporation takes place.

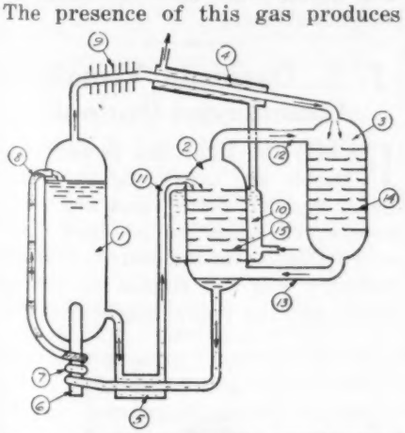


FIG. 1—DIAGRAM SHOWING CONSTRUCTION OF APPARATUS

1. Generator. 2. Absorber. 3. Evaporator. 4. Condenser. 5. Temperature exchanger, 6. Heating medium. 7. Thermosiphon. 8. Strong-liquid inlet. 9. Rectifier. 10. Cooling jacket. 11. Weak-liquid inlet. 12. Hydrogen inlet. 13. Mixed gas outlet. 14. Disks in evaporator. 15. Disks in absorber.

The construction of the apparatus is shown in Fig. 1. The unit is filled with a small quantity of aqua ammonia and hydrogen is introduced under a pressure that renders condensation of the ammonia possible at the usual temperatures of cooling water generally obtainable. Once filled the apparatus thus consists of a hermetically closed welded system and it is said to be so proportioned as to obtain stabilization, so that dissociation does not take place. The refrigerator is known as the "Electrolux."

By referring to Fig. 1 the following process of operation can be traced: When the generator (1) which contains the aqua ammonia, is heated, the ammonia evaporates and enters the condenser (4), where it is liquefied. The heating medium consists of a 300-watt resistance coil, or the necessary heat may be furnished by gas or any other suitable medium. Any water vapor that may be taken over with the ammonia is condensed and separated from the ammonia in the rectifier (9) and flows back into the generator. The ammonia leaving the condenser passes into the upper part of the evaporator (3), where it is met by hydrogen, which is continuously transmitted from the absorber (2).

The liquefied ammonia flows over a number of disks (14) in the evaporator, where it evaporates in and diffuses into the hydrogen. This evaporation and mixing goes on until the ammonia vapor has reached the partial pressure in the mixture of gases which corresponds to the existing conditions of temperature and pressure in the evaporator. As the ammonia thus diffuses into the hydrogen its partial pressure falls, but the total pressure in the evaporator remains the same as in all other parts of the apparatus. The gas mixture, consisting partly of hydrogen and partly of ammonia, is of a higher specific gravity than pure hydrogen, and, therefore, sinks down through the evaporator. During its passage through the evaporator heat is absorbed by the ammonia.

The gas mixture then flows through

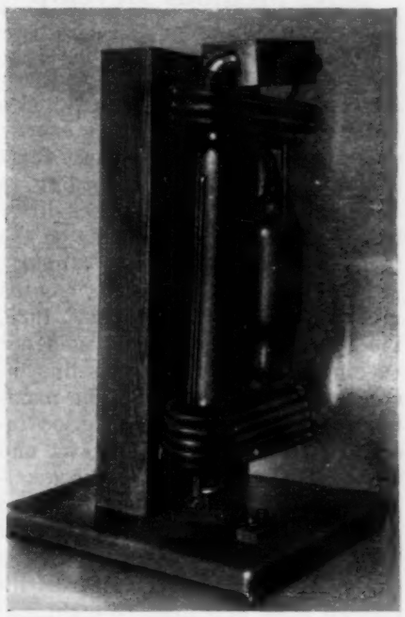


FIG. 2 — GENERATOR AND ABSORBER WITH RECTIFIER AND CONDENSER AT THE TOP AND THE HEAT EXCHANGER AT THE BOTTOM

the pipe (13) into the absorber (2), where it is met by a shower of water, practically free of ammonia, coming through the pipe (11) and passing over the disks (15) in the absorber. This water flows from the generator into the absorber by gravity and absorbs the ammonia in the gas mixture. The hydrogen denuded of the ammonia assumes the total pressure in the upper part of the absorber and again finds its way into the evaporator. A continuous circulation of hydrogen is thus maintained between the absorber and evaporator. No hydrogen can remain in the generator while the apparatus is working as it would be expelled by the ammonia vapor. The strong absorption liquid at the bottom of the absorber is returned to the generator using the thermosiphon principle. The temperature exchanger (5) preheats this liquid before it enters the generator and thus reduces the thermal losses.

The evaporator (not visible in Fig. 2) is inside of the cabinet. The balance of the apparatus outside is thoroughly insulated to reduce heat losses. About five gallons of cooling water per hour is said to be needed from the house water system.

Commercial Activities and Public Relations

Sales Methods Develop Farm Line

REGULAR sales methods and normal development have effected a 100 per cent increase in the energy sales per customer on the test farm line at Renner, S. D., according to Prof. Ralph L. Paddy, project director, in his report of progress on the line since its completion in January, 1924. During the twelve months from August, 1924, to August, 1925, the average kilowatt-hours sold per customer per month on this line increased from 68 to 132. The maximum demand during this period increased from 11 kw. to 19 kw., and the average hours use of the maximum demand for the line increased from 100 hours in August, 1924, to 115 hours in August, 1925. During this period the number of farms increased from seventeen to eighteen.

The test line was built and paid for by the Northern States Power Company, Sioux Falls division, and is of 2,300-volt, single-phase construction, using No. 3 bare copper wire. It is served from a 22,000-volt transmission line. The farm line is 8.4 miles long and is now serving eighteen farms. Every farm, with one exception, is served by a 3-kva. transformer. This size of transformer has been found adequate to serve 5-hp. motors, six of which are now in use on this line. Each farmer pays the cost of his stub or service and also the cost of all wiring and equipment used on his farm. The pole line cost the power company $913.50 per mile. The average cost to the farmer for his stub-line was $136.98. The average investment in motors and appliances on each farm was $315.50 and for wiring $166, making a total investment on the average farm $609.48, or two-thirds of the cost of the line itself.

The policy of the South Dakota committee with respect to this line was to allow its development to proceed normally, subject only to the sales efforts of the electrical interests in the community. Practically no free equipment was furnished any of the customers.

The results of this policy are indicated by reports showing that at the time the line was completed there were very few appliances on any of the farms; within three months there were twenty-six motors, and after twelve months there were forty-nine motors divided as follows: Nine milking machines, five refrigerators, eight feed grinders, nineteen water pumps.

The test line is operating under a tentative rate schedule bearing a fixed charge of approximately $8 per month per customer plus 5 cents per kilowatt-hour for the first 30 kw.-hr. and 3 cents per kilowatt-hour for additional energy.

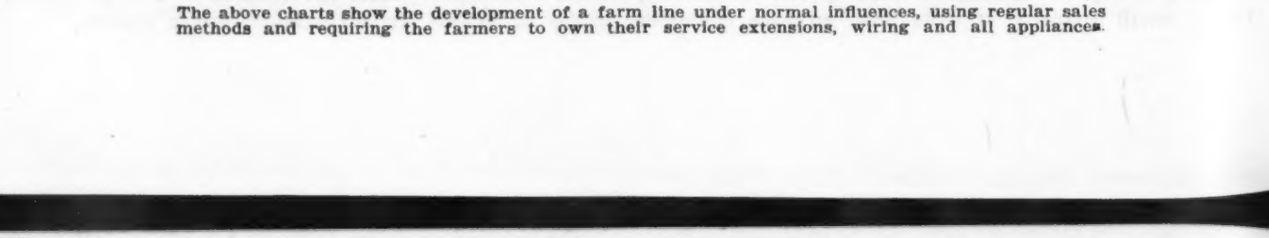
DATA FROM THE RENNER, S. D., RURAL LINE

Month 1924	Fixed Charge, Total	Total Consumption, Kw.-Hr.	Average per Customer 17 Farms, Kw.-Hr.	Total Bill	Average Bill for Customer	Peak Load
January	$7.90	748	41.12	$158.22	$9.89	5.0
February	8.27	800	50.0	165.37	10.335	8.3
March	7.85	779	45.8	166.04	9.767	6.1
April	7.97	820	48.24	168.99	9.94	6.0
May	8.06	810	47.7	169.82	9.99	6.5
June	8.35	752	44.2	172.34	10.14	8.0
July	8.04	754	44.35	166.82	9.813	8.8
August	7.98	1,162	68.352	170.13	10.007	8.5
September	7.98	1,355	79.7	185.89	10.93	8.5
October	7.98	1,457	85.7	189.09	11.12	8.5
November	7.93	1,911	112.4	199.34	11.73	8.5
December	7.93	1,997	117.47	201.54	12.24	8.5

Total Line Load, Watts		Average Line Load		Total Line Load, Watts		Average Line Load	
July 1, 1924				Jan. 1, 1925			
Light	23,990	Light	1,493	Light	23,990	Light	1,498
Motor	20,700	Motor	1,290	Motor	39,626	Motor	2,403
Appliance	8,940	Appliance	559	Appliance	22,190	Appliance	1,338

J. E. Davidson Visualizes Commercial Outlook

ELECTRIC light and power companies are expanding at a rate never equaled before and are in as prosperous condition as they have ever enjoyed, but the entire electrical industry has the chance to benefit itself, and the public still more, if it



MAXIMUM DEMAND AND KILOWATT-HOUR CONSUMPTION OF RENNER, S. D., RURAL LINE

The above charts show the development of a farm line under normal influences, using regular sales methods and requiring the farmers to own their service extensions, wiring and all appliances.

will only take advantage of the opportunities before it right now, declared J. E. Davidson, president of the N.E.L.A. before the St. Louis Electrical Board of Trade recently.

As an indication of conditions, he pointed out that the electric utilities of the United States are requiring new capital at the rate of $2,000 a minute for new construction and extensions. Fourteen states have legalized electric utility bonds as investments for savings banks. Insurance companies have seen fit to place 20 per cent of their entire investments in utility securities, and one company even has $4.12 of such securities for every one of its 22,000,000 policy holders. In the face of 65 per cent higher living expenses than before the war, utilities, as a whole, are furnishing service at 8 per cent less cost to the customer and besides are contributing $150,000,000 in taxes each year. This is the equivalent of $7 per family if political ownership were substituted. The prices of some utility common stock are not justified either by property value or by earnings, but this cannot be said of utility preferred stocks and bonds which the public is buying.

Getting down to some commercial opportunities that exist, Mr. Davidson urged utilities and contractor dealers in particular to pay more attention to the opportunities in domestic, commercial and industrial lighting. "Organize lighting departments or establish lighting specialists where they do not exist," he recommended. Now that the public has been educated and interested in the fundamental principles of good lighting, who is going to give specific lighting information or advice? Drug and department stores can't. Utilities are in varying degrees. Contractors should to a greater extent. The industrial lighting campaign has immediate commercial value, it was emphasized, as contrasted with the purely educational value of the home-lighting campaign. To get results readily, Mr. Davidson recommended making demonstration or trial installations on customers' premises.

Both utilities and contractor dealers have been lax in electrifying homes, it was contended. Why wait ten years to effect complete electrification, Mr. Davidson asked, when a little harder work will accomplish the results in three years, emancipating the housewife and benefiting the electrical industry simultaneously? There is a great future for domestic refrigeration. It is here to stay. Many hundred thousand will be sold in the next few years, it was prophesied.

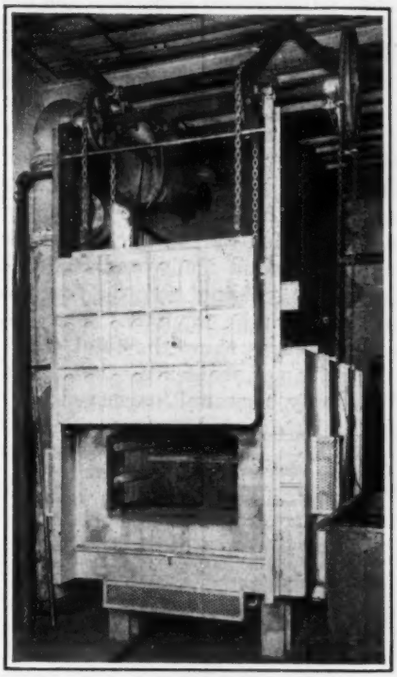
Utilities have profited more than some of them realize from radio broadcast reception so far, by reason of the greater and longer use of home lighting during reception. As socket operated sets become more extensively used, utilities can expect to benefit more.

Although rural service is possibly looked upon now about as favorably as domestic lighting was fifteen years ago, it will be just as attractive as urban domestic load or more so in the future, Mr. Davidson commented. "Get into it and let the farmer know you are just as interested in serving him as he is in service," was the suggestion.

Opportunities also present themselves in the electricatifion of railroad terminals and some trunk lines.

A Record for Electric Heat

THE Milwaukee Service Parts Company, Milwaukee, Wis., installed an electric heat-treating department to eliminate difficulties experienced with commercial heat-treaters, and the electrical method has proved so successful that the management states it would not care to continue in business if outside heat-treating in fuel-fired furnaces had to be depended upon. The principal material treated is automotive piston pins, which are passed through hardening and carbonizing processes. Hardening is done in an 8-kw., box-type furnace operating at 1,500 deg. F. and the carbonizing in an 80-kw. furnace at 1,650 deg. F. Both furnaces were built by the Hevi-Duty Electric Company and are equipped with automatic temperature control.



ELECTRIC CARBONIZING FURNACE IN WHICH 55,000 PISTON PINS WERE TREATED WITHOUT A REJECT

The carburizing furnace is charged with fourteen metal pots holding 1,200 pins by the day shift and current is turned on at 2 a.m. by the night watchman. The furnace and charge are brought up to temperature by 3 a.m. and the charge is pulled by the day shift at 7 a.m., when the furnace is again loaded and the cycle repeated. The day shift production of the furnace is completed by noon and it is again loaded and held for the night heating. This schedule keeps the furnace load off the customers' peak, hence no additional demand charge is entailed. As the night watchman starts the furnace for the night shift, no labor cost is chargeable during the carburizing period, the only labor being that of loading and unloading the furnace twice a day. Production of the hardening and carburizing furnaces has averaged 70,000 pins per month. A typical month's production data are given in the accompanying table.

MONTH'S PRODUCTION DATA OF ELECTRIC HARDENING AND CARBURIZING FURNACE

Number of pins double heat-treated	70,000
Energy consumption (kw.-hr.)	11,360
Pins double heat-treated (per kw.-hr.)	6.2
Average rate per kw.-hr. (cents)	2.9
Energy cost of hardening and carburizing one pin (cents)	0.47

Specific advantages of electric heat-treatment of the piston pins have been detailed by the general manager of the Milwaukee Service Parts Company as: No rejects from 55,000 pins treated, more uniform depth of case (1/64-in.), greater hardness (5 to 10 points increase), increased strength.

The resistance of the pin to crushing load was increased from 44,000 lb. to 64,000 lb. with the pin placed between flat surfaces. When supported at extremities and loaded at center, the electrically heat-treated pins showed a strength of 14,000 lb. compared with 8,000 lb. for the fuel-fired furnace treatment.

How Many Appliances Are in Use?

Results of Survey Embracing Twenty Communities Served by One Power Company in a Western State

TO DETERMINE the present degree of appliance saturation in the homes of its domestic customers one of the electric power companies in the West recently made a careful survey of a large part of its urban and rural territory. This company serves a population of about 130,000 and has a total of more than 26,000 residence customers, a very high degree of saturation as far as number of customers is concerned. This territory comprises twenty communities, quite widely scattered, and a large amount of rural country where the use of electricity in the home is highly developed.

Out of this territory certain towns were selected for intensive study, to give a true average for the entire system, and every connected house was visited and a careful check made of what electrical appliances are in use. The same thing was done with a number of rural lines, where every connected farm was visited and a record made of the home equipment installed. These figures were then reduced to percentages and tabulated to show the relative popularity of the principal appliances and the degree to which they are being used. The results are shown in Table I.

Based on a study of these figures and a reckoning of the length of time that had been devoted to the sale of each appliance in these communities and the effort that had been applied to their promotion, an estimate was made of the probable degree of saturation that could be expected for each of these appliances and the length of time that would be required at the present rate of progress to complete the job. It resulted in the estimate given in Table II.

On this calculation ten years would be required to complete the full equipment of all the homes now served, if selling continues at the same rate, which is at the average of $15.42 per customer, for the entire system. By increasing the pressure on the selling or introducing appeals that would accelerate the development of the market, of course, this time might be reduced to six years, in the judgment of the company.

As the basis for the estimate it was necessary to find out how much appliance equipment is being sold at present by the company to the homes in this section by the electric power company, and a study was made of the merchandising records for the first six months of 1925. The following figures show the total appliance sales per residence customer in the twenty communities served:

Community No.	Merchandise Sales per Residence Customer	Community No.	Merchandise Sales per Residence Customer
1	$19.11	11	$10.57
2	17.48	12	9.50
3	16.02	13	8.97
4	15.99	14	8.34
5	13.86	15	7.74
6	13.61	16	7.67
7	13.31	17	7.26
8	12.60	18	6.92
9	11.04	19	6.92
10	10.93	20	6.72

It is interesting to note the variance in the total sales per home, and they are therefore arranged in this relation. Community No. 1, in which there are 227 homes, sold an average of $19.11 per household customer, while community No. 20, in which there are 515 homes, sold but $6.72 per residence in the same period. The general conditions in the two towns are practically the same and the average income per residence customer in the first instance was $21.94 in 1924, and in the latter it was $20.84, indicating the effect of appliance sales on the residential consumption of energy. Commercial activity in community No. 20 has not been so aggressive as in others nearer the top of the list. More sales pressure is being exerted in those communities having low merchandise sales per customer and this is expected to increase the amount of appliance business as well as the energy consumption per customer.

TABLE I—RELATIVE USE OF TEN PRINCIPAL ELECTRICAL APPLIANCES IN CITY AND RURAL HOMES

Appliance	Per Cent of Customers Now Using: City and Town Homes	Rural Homes	Average for Territory
Flatirons	94	79	88
Washing machines	64	52	59
Cleaners	47	18	34
Ranges	38	26	24
Water heaters	35	18	16
Percolators	25	7	16
Toasters	24	7	16
Waffle irons	20	5	13
Kitchen units	10	10	10
Ironers	2	1	1

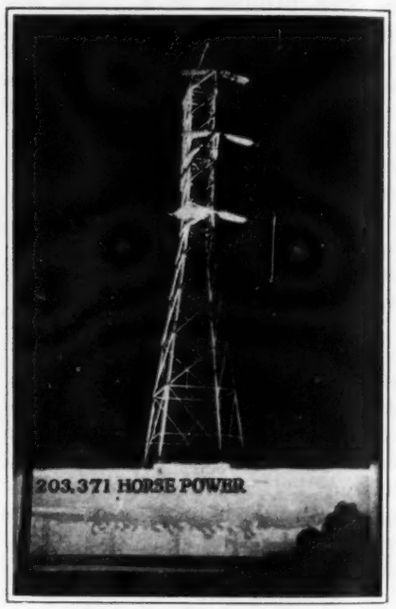
TABLE II—DEGREE AND TIME REQUIRED TO REACH SATURATION

Article	Estimated Saturation Point Should Be	Time to Reach Saturation Point, Years
Irons	100	12
Cleaners	98	3
Washing machines	80	5
Kitchen units	80	12
Ranges	70	12
Toasters	60	12
Percolators	60	10
Waffle irons	60	12
Water heaters	50	14
Ironers	50	10

Capitalizing Floodlighted Transmission Towers

BY ERNEST J. TEBERG
Lighting Sales Engineer, Public Service Company of Northern Illinois, Chicago

AT A prominent point on the Dixie Highway the Public Service Company of Northern Illinois has located an illuminated bulletin board immediately in front of one of the company's 132,000-volt transmission line towers. By means of a floodlight the tower becomes a part of the bulletin board at night. The floodlighted tower can be seen for more than a mile and serves to focus attention on the bulletin board. The tower is lighted by one 1,000-watt Pyle National Projector, having a prismatic lens giving a ribbon beam. This type of equipment was selected in order that the projector could be placed alongside the tower, directly behind the bulletin board, as it was impracticable to place the projector across the highway because of glare. Favorable comment on this installation has encouraged the company to locate additional similar bulletin boards on prominent highways where use could be made of adjacent transmission towers.



USE OF BULLETIN BOARD AND FLOODLIGHTED TRANSMISSION TOWER

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Valmont Station.—R. R. THORNE.—This article describes a new station of the Public Service Company of Colorado, burning pulverized coal and deriving its cooling water from the floodwaters of snow-fed mountain streams, which are stored in an artificial lake. The initial installation comprises one 25,000-kva. turbo-generator and other elements to correspond. The description is accompanied by abundant data on the principal equipment and by illustrations.—*Power Plant Engineering*, Sept. 15, 1925.

Lake Waters for Condensers.—A. G. CHRISTIE.—The paper discusses the phenomena connected with the stratification of large bodies of quiescent waters in the cooler regions of the United States and indicates the savings possible by the proper design of condensing water intakes to take advantage of the cold waters in the lower layers. So locating the intake that the cold-lower strata could be used would, in the author's view, probably enable a plant to maintain a 29-in. vacuum, or better, throughout the year. For a 100,000-kw. plant, with a use factor of 40 per cent, the saving under typical conditions that would attend improvement of the vacuum from 28 in. to 29 in. during four and one-half months of the summer is computed to warrant additional capital expenditures up to $308,000.—*Mechanical Engineering*, October, 1925.

Latest Design and Practice in Power Plants.—This report by the committee on power generation reviews important technical achievements of the last year and discusses the trend of modern practice. Charts show the improvement in the performance of typical central stations of 60,000 kw. or over from 1913 to 1925, during which period the B.t.u. requirement per kilowatt-hour has fallen from about 22,500 to 14,500, exclusive of the further reduction brought about by the introduction of the mercury vapor-steam cycle; the trend of operating costs and fixed charges during the same period, with the peak in 1920-21 and the aggregate rise of about 60 per cent, despite a reduction in fuel costs per kilowatt-hour almost down to the former level, and, finally, the decrease of unit-capacity factors with increasing age of the turbo-generators. For hydraulic units the consensus of opinion seems to point to a figure around 100,000 hp. as the largest practicable size under present limitations as to shop equipment and material.—*Journal A. I. E. E.*, November, 1925.

Generation, Control, Switching and Protection

Power-Plant Operating Costs.—Typical power-plant costs are given in a variety of industries where steam is required for heating and process. Comparison with purchased service in these instances at prevailing rates is favorable to the industrial power plant. Among plants analyzed are those of hotels, candy and cracker factories, shoe factories, office buildings, knitting and textile mills. A considerable mass of detailed data is assembled.—*Power*, Oct. 27, 1925.

220,000-*Volt Transmission and Transients.*—R. J. C. WOOD.—The results are here given of a study of the causes of flashovers on the Southern California Edison lines. Among the devices used were a photographic surge recorder and a "klydonograph." Records as made by these instruments are reproduced. In addition to the conviction that birds are to blame for the disturbances the conclusions were reached that corona in the amount found upon arcing horns did not cause flashovers, nor did voltage surges; switching causes rises of voltage as great as any recorded; voltage rises recorded at the times of two flashovers may have been due to switching; high-voltage switching as practiced on this system may be done without fear of danger; voltage surges rarely travel even 35 miles without being greatly attenuated; there were no harmonic resonances; residuals to ground were small; there were no sustained high-frequency effects.—*Journal A. I. E. E.*, November, 1925.

Transmission, Substations and Distribution

Underground Fiber Conduits for High-Tension Cables in Bergen.—LARS RIVENES.—A description of the conduit system that has been adopted in the city of Bergen, Norway, in the reconstruction of the part of the city that was destroyed by fire in 1916.—*Teknisk Ukeblad* (*Norwegian*), Oct. 2, 1925.

Wind Stresses on Steel Towers—H. VARLET.—A combination of mathematical and graphical methods is developed in this article to determine the wind stresses upon fabricated steel transmission towers, and it is shown that in most cases the resultant stress attacks the tower at about one-half of its height. Formulas are also given to calculate the total wind force on a given tower. Actual examples indicate the proper use of the theoretical findings.—*Revue Générale de l'Electricité*, Oct. 17, 1925.

The 60-Cycle Distribution System of the Commonwealth Edison Company.—W. G. KELLEY.—The larger customers are supplied by means of industrial substations fed from 22,000-volt, three-phase, underground loop circuits. The general load is supplied by means of 2,300/4,000-volt, three-phase, four-wire radial circuits from the various manually operated and remote-control substations. The generator capacity was 420,000 kva. and the maximum load 379,000 kva. as of January 1, 1925, for the 60-cycle portion of the system. Further details regarding the system given in the article include a map of generating stations and substations, diagrams of bus connections for manually operated and remote-control substations, typical daily load curves for a substation, and a discussion of the advantages and disadvantages of proposed new methods for meeting the demands of increasing load density in some sections of the city. Experience has shown that a winter load of 200 amp. per phase can be economically carried on No. 0 underground cable, thus materially exceeding the former limitation to 150 amp.—*Journal A. I. E. E.*, November, 1925.

Units, Measurements and Instruments

New Measuring Instruments.—S. HELD.—The paper describes a series of instruments suitable for accurate and direct measurement of phase displacement, frequency, synchronism, resistance and temperature (pyrometers). All the instruments are based on the electrodynamic principle, with one stationary and one or more movable windings. In spite of the exceedingly small weight of the revolving elements, all the instruments develop sufficient torque to serve well as curve-drawing types. The author goes into considerable detail to develop mathematically the theory of each instrument in order to show its accuracy and limitations.—*Revue Générale de l'Electricité*, Oct. 10, 1925.

Measurement of Electrical Output of Large Alternating-Current Turbo-Generators During Water-rate Tests.—EVERETT S. LEE.—This is a reprint in abstract of the author's article in the August issue of the *A. I. E. E. Journal*, to which reference has been made in the Digest.—*General Electric Review*, November, 1925.

Inductance and Capacity: Effects of Harmonics on Their Apparent Values.—PHILIP KEMP.—When an emf. of complex wave form is applied to a simple inductance, the simple formula $E = 2\pi fLI$ no longer holds. For example, let

$$E = \sqrt{\tfrac{1}{2}(E_1^2 + E_3^2 + E_5^2 + \ldots\ldots)},$$

then the current wave will also contain higher-frequency components, and the apparent inductance is increased in the ratio

$$\sqrt{\frac{E_1^2 + E_3^2 + E_5^2 + \ldots}{E_1^2 + E_3^2/_9 + E_5^2/_{25} + \ldots}}$$

The percentage increase for various amplitudes of the first three odd harmonics is given. Similarly, the apparent capacity is affected by the presence of harmonics in the emf. wave but to a much greater extent, as is evident from tables given.—*Electrician* (*England*), Oct. 23, 1925.

Illumination

Advantages of Highway Lighting.—F. M. REAST.—The author takes the view that with properly installed highway lighting units automobile traffic can proceed at night with the same speed, safety and comfort as by day. Other advantages are mentioned. A bilateral lighting unit is illustrated, the arrangement of reflectors and refractors being shown. Series lamps of 2,500 lumens are used, spaced fifteen

or twenty to the mile, and mounted 25 ft. to 35 ft. above the road surface.—*Electric Journal*, November, 1925.

Motors and Control

Ventilation of Large Induction Motors.—D. F. ALEXANDER.—Methods of automatic and forced ventilation are discussed and illustrated by sectional drawings and views.—*Electric Journal*, November, 1925.

Calculation of Temperatures and Heat Losses in Cylindrical, Ring-Lubricated Bearings.—SVEN HJERTÉN.—A short review of the latest theoretical and experimental results on this subject.—*Teknisk Tidskrift (Swedish), Mekanik*, Oct. 17, 1925.

Heat Applications and Material Handling

Recent Experience on the Manufacturing and Operation of Porcelain Insulators.—J. C. HOLST.—The author gives a very complete discussion of the most important features of the manufacturing and operation of porcelain insulators, viz., (1) their external form, (2) the properties of the materials of which they are made, (3) the cementing of their various parts, and (4) their inspection and testing.—*Meddelelser fra Norske Elektricitetsverkers Forening*, October, 1925.

Steel Direct from Iron Ore.—HENNING FLODIN.—This is an abstract of a paper presented at the autumn meeting of the Iron and Steel Institute, describing experiments carried out at the Royal Technical High School in Stockholm, Sweden, using an electric furnace at a load of about 30 kw. The results were so satisfactory that trials were undertaken on a larger scale in a 250-kw. to 300-kw. furnace, where one ton of iron was produced with an expenditure of 2,700 kw.-hr. The gross expenditure in a 3,000-kw. furnace, it is computed, will be 2,162 kw.-hr. per ton. The heat content of the waste gases amounts to between 2,700 calories and 2,900 calories. The reduction proceeds uninterruptedly and continuously. Iron and steel of any desired carbon percentage can be produced at successive tappings without difficulty. The quality is stated to be superior to both the open hearth and the Bessemer products.—*Iron Age*, Nov. 5, 1925.

Electrophysics, Electrochemistry and Batteries

Electrolytic Condenser.—A. SOULIER.—Electrolytic action between two metallic electrodes in acidified water will not take place until a certain critical voltage has been reached, which depends upon the metal and the electrolyte used. Before this voltage is reached the arrangement acts as a condenser, giving, for example, a capacity of 10 microfarads per square centimeter for a cell platinum—one-sixth sulphuric acid. After testing a number of various metals, it was found that tantalum and aluminum offer the highest critical voltage. This phenomenon is ascribed to a fine film of oxide or gas which is formed upon the surface of the metallic electrodes and which insulates them from the liquid. Using aluminum plates as electrodes, the author has developed a commercial electrolytic condenser with 350-volt critical potential per cell. The film has a life of about one day, so that such a condenser has to be charged daily. It is claimed that this type of condenser has a number of advantages over the solid dielectric type. Various applications for it, such as power-factor improvement, motor starting, use as an adjunct to an asynchronous generator, etc., are described.—*Bulletin de la Société Française des Electriciens, No.* 46, 1925.

Simultaneous High-Frequency and Direct-Current Resistances of Fine Wire at Various Temperatures.—J. D. STRANATHAN.—By sending currents of the order of frequency of 300,000 cycles simultaneously with direct current and measuring the currents and potential drops with appropriate instruments while blocking out the undesired kind by suitable condensers and inductances, it was found that the resistances agreed within the accuracy of measurement (± 1 per cent). This was true whether the wires were in air, vacuum or hydrogen. The temperature range for the tests was from 20 deg. to 750 deg. C. — *Physical Review*, October, 1925.

Traction

Diesel-Electric Cars for the Canadian National.—The Canadian National Railway has developed and recently placed in service the first of an order of nine Diesel-electric cars which are being built at its Point St. Charles shops, Montreal, Quebec. Seven are 60-ft. single cars and two are articulated, with an over-all length of 102 ft. The four-stroke-cycle engines have cylinders of 8½-in. bore and 12-in. stroke. Those of the smaller units have four cylinders, develop 185 b.-hp. at 700 r.p.m. and weigh 2,750 lb. Corresponding figures for the large unit are eight, 340, 650 and 5,450. The generator of the articulated car is differentially compounded, with 300-volt battery excitation for the shunt field, and is rated at 200 kw., 600 volts. The engine is started from the battery by using the generator as a motor. The driving motors are 600-volt railway type, with a one-hour rating of 145 amp., connected permanently in parallel, mounted two on each of the front and rear trucks, and driving the axles through helical gearing.—*Railway Age*, Oct. 17, 1925.

Rail-Bond Tester.—G. PALANCHON.—By means of a specially equipped car, made at small expense out of an old trolley car, the rail bonds of a street-car line can be quickly tested for their electric resistance. The car is propelled at about 5 miles per hour over the track. Within the car is a small motor-generator set which delivers 300 amp. to 1,000 amp. at 5 volts through the axle-insulated wheels into the rails. A millivoltmeter indicates by a more or less pronounced deflection the relative values of each rail joint passed. In some cases it may be found more advantageous to couple an ordinary motor car to a trailer, the two being electrically insulated. In this case the millivoltmeter is connected between the two cars, and the trolley current itself is used to test the joints. The latter method gives less accurate results.—*Revue Générale de l'Electricité*, Oct. 17, 1925.

Telegraphy, Telephony, Radio and Signals

Transoceanic Radio Station at Warsaw.—WILLIAM G. LUSH, FRED E. JOHNSTON and J. LESLIE FINCH.—A brief history and description, with illustrations, of this Polish station is given. Technically the system is similar to that used in the United States by the Radio Corporation.—*Proceedings of the I. R. E.*, October, 1925.

Detecting Characteristics of Electron Tubes.—H. M. FREEMAN.—With the development of the art the use of general-purpose tubes in receiving sets is becoming of less importance than formerly, and the use of detector tubes designed for their special function is becoming increasingly desirable. Taking the well-known analysis of the operation of a detector tube with condenser and grid leak, curves are derived in this paper from the static characteristics of a typical general-purpose tube, showing its performance as a detector under certain conditions of operation. A method is described of measuring the output with a standard incoming signal, and the experimental and theoretical curves are compared. Sample curves show the wide variations in efficiency of certain types of standard tubes with relatively slight changes from the customary operating conditions, and also the variations of a number of similar tubes under normal operating conditions.—*Proceedings of the I. R. E.*, October, 1925.

Underground Telephone Cable from Stockholm to Gothenburg in Sweden.—A. M. ANDERSSON.—This cable replaces the old overground lines in conjunction with the electrification of the railroad between the same points. This railroad is operated with single-phase current of 16,000 volts at 16⅔ cycles. Telephone interference is largely prevented by return wire and booster transformers, but there is no absolute assurance against the induction of high voltages in exceptional cases. For this reason the construction of the cable is somewhat different from that of ordinary telephone cables. The author gives a detailed description of the construction of the cable, as well as results of tests.—*Teknisk Tidskrift (Swedish), Elektroteknik*, Oct. 3, 1925.

Miscellaneous

Electric and Other Machine-Manufacturing Export Industries in Sweden.—AXEL F. ENSTRÖM.—The author reviews the particular branches of the machine industry in which Sweden has been able to compete in the world market. The most important of the branches under discussion are steam turbines, steam and electric locomotives, electrical equipment in general, internal-combustion engines, cream separators, ball bearings and special machine tools.—*Teknisk Tidskrift, General Section*, Oct. 31, 1925.

News of the Industry

Spending $555 for 1 Hp.

This Represents Capital Outlay of New Brunswick's Provincial Plant—Operating Deficit Large

WHEN the newly appointed Electric Power Commission of the Canadian Province of New Brunswick took office one of its first acts was to arrange for an audit of the books and accounts of the commission in order to make the members fully acquainted with what had been done by their predecessors. The auditors' report has just been made public and shows that for the period beginning October 31, 1923, and ending August 31, 1925, the commission had an operating deficit of $134,224, of which $107,548 was chargeable to the Musquash development and $26,676 to the Bathurst system. The operating deficit for the Musquash system for the period from October 31, 1923, to October 31, 1924, was $88,716 and for the period from October 31, 1924, to August 31, 1925, it was $45,508.

The capital outlay on the Musquash to August 31, 1925, amounted to $3,337,483, and the capital cost per horsepower, including the transmission lines, based on the present peak load, is given as $555 a horsepower. Based on the sale of 15,000,000 kw.-hr. a year, it would require a rate of 2.79 cents a kilowatt-hour to provide the necessary amount of revenue to meet the carrying charges on the Musquash system, the report says. The contract of the city of Moncton calls for the delivery of from 5,000,000 kw.-hr. to 7,000,000 kw.-hr. at 2.25 cents a kilowatt-hour and the contract of the city of St. John for the delivery of 10,000,000 kw.-hr. to 15,000,000 kw.-hr. at 1.2 cents a kilowatt-hour.

The causes of the losses, the auditors say, appear to be unsatisfactory contracts with St. John and Moncton, heavy interest charges, sinking-fund requirements and maintenance reserve allowance on the high capital cost, and the high cost of purchased power at Bathurst and the selling of such power below cost.

Union Electric Light & Power Takes Over Keokuk Dam

The Mississippi River Power Company and its affiliated lines in the Keokuk district, including the hydro-electric dam and power plant of the Mississippi River Power Company at Keokuk, Iowa, and Hamilton, Ill.; the Fort Madison (Iowa) Electric Company, the Keokuk Electric Company and the Dallas City (Ill.) Light Company, on December 1 passed from Stone & Webster control to the Union Electric Light & Power Company of St. Louis. The utilities affected serve 1,250,000 people, the hydro-electric plant developing 170,000 hp. for manufacturing concerns in St. Louis and adjacent factories, while the three electric companies have been under management of the Stone & Webster company since 1913, when the Keokuk Dam was finished.

The transfer of the big power unit was forecast recently by exchange of stock of the two companies, as announced in these columns, but it was not then expected that the local plants would be affected. Engineering conditions are given as the reason for the sale, the Keokuk plant not controlling a reservoir of water sufficient to maintain power output at the maximum, thus necessitating the purchase by Stone & Webster of steam-generated power from the Union Electric company in St. Louis, while if the maximum guaranteed were limited to the low stage of water, there would be a huge waste.

Pleads for Research in Pure Science

Hoover Tells A. S. M. E. Convention of Danger from Its Neglect—Lags Far Behind Industrial Research—Three Lines of Support Needed

PROMINENT among the features of the New York City convention of the American Society of Mechanical Engineers, held this week, was a public address by Secretary of Commerce Hoover on "The Vital Need for Greater Financial Support to Pure Science Research." This address constituted the Henry Robinson Towne lecture of 1925. Mr. Hoover took the ground that America is lagging behind Europe in the matter of research in pure science as distinguished from industrial research.

"There is no body of men more interested in the advancement of pure science than our engineers," said Mr. Hoover, "for the engineering profession is built upon the application of scientific discovery. Research in the biological and physical sciences takes two forms—industrial research, which is the application of science, and research in pure science. Obviously there must first be a pure science before there can be an application. I am aware that there is a twilight zone between them, but no scientist has difficulty in finding the borders. While we have in recent years developed our industrial research upon a scale hitherto unparalleled in history, we have by no means kept pace in the development of research in pure science. We have an increase in ten years from one hundred to over five hundred laboratories engaged upon search for applications of known scientific fact and law. These results have been magnificent. But all these applied science laboratories are dependent upon the raw material which flows from the laboratories and men engaged in pure science, and the industrial investigators are the first to demand more support to pure science.

"Not only is our nation today greatly deficient in men and equipment for this patient groping for the sources of fundamental truth and natural law, but the sudden growth of industrial laboratories has in itself endangered pure science research by drafting the personnel of pure science into their ranks—depleting at the same time not only our fundamental research staff, but also our university faculties, and thus to some degree drying the stream of creative men at the source. Thus applied science itself will dry up unless we maintain the sources of pure science. This is no complaint against our great industries and their fine vision of the application of science. It simply means we must strengthen the first line of our offensive. The day is gone by when we can depend very much upon consequential discovery or invention being made by the genius in the garret. A host of men, great equipment, long, patient scientific experiment to build up the structure of knowledge, not stone by stone, but grain by grain, is today the fundamental source of invention and discovery."

The whole of the income available from sources for research in pure science, Mr. Hoover said, does not exceed $10,000,000 a year, whereas in the professional schools of our universities, in technical and agricultural colleges and experiment stations, in industrial laboratories and in government bureaus $200,000,000 a year is probably expended upon applied science research. The problem as he saw it is to obtain much larger support, first, to university men, in order that they may be able to give a larger proportion of their time to research; second, to coordinated research for certain definite purposes, and, third, to the institutions of pure science research.

"There is no price," Mr. Hoover said in conclusion, "that the world could not afford pay to men who have the originality of mind to carry forward scientific thought by great strides—and they wish no price. They need opportunity to live and work. No one can estimate the value to the world of an investigator like Faraday. Our whole banking community does not do the public service in a year that Faraday's discoveries do us daily. As national assets men of his type, even when much less gifted than Faraday in the past and Millikan today, are beyond valuation, and no effort should be spared to facilitate their work. Only thus can they be reasonably expected to make the best use of their willingness to advance knowledge, and therefore civilization, without thought of personal gain."

Reports on Muscle Shoals Given Out

Majority for Imperative Manufacture of Fertilizer, Even by Resort to Government Operation—Minority Insist on Lease and Favor Controlling Board

EARLY this week the majority report of the Muscle Shoals Commission was given out from the White House, together with a summary of the minority report, which later on was released in its complete form. Both reports followed closely the predictions made in the ELECTRICAL WORLD and other papers as to their purport. The majority members—Chairman McKenzie, Senator Dial and R. F. Bower—decrying public operation, but viewing it as a probable contingency if their views of the proper disposition of the government plants are to be carried out, made the following recommendations, the phraseology being here somewhat abbreviated:

FERTILIZER MANUFACTURE FIRST

"1. There should be definite limitations placed upon the power to be distributed from Muscle Shoals in order to protect the power supply for fertilizer manufacture, which is the primary purpose of the enterprise. We do not believe, however, that the hydro-electric properties at Muscle Shoals should be operated as isolated plants. This plan would not be economic because the water supply, and therefore the power supply, of the Tennessee River is very variable, and a larger supply of power for all purposes would be made available by interconnecting these plants with the general distribution system of the Southeastern States. Power transmission, to be most effective, should take place in both directions, and the resulting exchange in power would have great economic value to the entire section. It is pertinent in this connection to state that only eight of the eighteen units provided for have been purchased, and more could be installed and used from time to time as the demand justifies.

"2. Since, in our judgment, the operation of the nitrate plants can best be accomplished, and their benefits for the national defense and to agriculture can best be assured, by considering and dealing with the properties so dedicated as a unit, they should be leased as a unit and not as separate entities.

"3. That in order to safeguard the interests of the government and insure the faithful performance of the contract, any legislation authorizing or providing for the leasing of the property should specify distinctly that any such lease must contain the following specific covenants and conditions: (a) That no lease shall extend over a period of more than fifty years; (b) that the lessee shall maintain the property in good repair, but shall not be required to guarantee the stability of leased dams; (c) that the lessee shall supply power to operate all navigation locks free of cost; (d) that the lessee shall pay an annual rental not less than 4 per cent of the actual cost of the dam, flowage rights and power-house facilities and such an amount of rental on the steam-power plant as may be fair less an amount properly chargeable to navigation improvement; (e) that the lessee shall set up adequate sinking funds to return to the United States its entire investment in the properties; (f) that the hydro-electric property shall be interconnected with the general distribution system of the Southeastern States and that the lessee shall provide for the distribution to the public of a reasonable amount of power not needed for the manufacture of fertilizer; (g) that the lessee shall be required to manufacture [in specified and increasing quantities] nitrogen and other commercial fertilizers or concentrated ingredients for commercial fertilizers or both, either mixed or unmixed, and with or without filler, on the property covered by the lease or at such other plant or plants as the lessee may construct, using the most economical source of power available; (h) that the profit to the manufacturer should not exceed 8 per cent on fair annual cost of production; (i) that the lessee shall agree to determine by research whether or not, by means of electric furnace methods and industrial chemistry, there may be produced on a commercial scale fertilizer compounds of higher grade and at lower prices than in the past, and shall employ such improved methods if they are found; (j) that the lease should be made only to American citizens; (k) that proper guarantees for the performance of all the provisions of the lease shall be provided by legislation; (l) that the lessee shall agree to the creation of a board representing agriculture which shall audit the cost of production of fertilizer and determine its territorial distribution; (m) that legislation should provide for the immediate operation of the properties by a government corporation in the event that a private lease is not obtained by the President after reasonable effort.

"4. In order to stabilize the power supply at Dam No. 2 and enhance the value of the present government investment and to provide facilities making possible greater production at Muscle Shoals, the construction of Dam No. 3 is recommended, provided that said dam can be leased under the same general terms and conditions as Dam No. 2."

MINORITY REPORT

The twenty-page minority report, signed by H. A. Curtis and William McClellan, insisting that private leases are indispensable and that separate power and fertilizer leases should be made, contains the following recommendations:

1. That Congress establish the Muscle Shoals Board with five members appointed by the President for five-year terms.

2. That all the power of the Wilson Dam, with the steam plant in Nitrate Plant No. 2 used as an auxiliary, be reserved for a period of two years from the time the necessary legislation becomes effective, and that 75,000 primary horsepower together with 30,000 secondary horsepower be reserved for an additional year, all for the purpose of manufacturing fertilizer or utilizing the equipment of Nitrate Plant No. 1 or 2; those receiving the power to have the right to use it continuously but not to resell any of it; all reserved power to be delivered to such customers and in such amounts as may be specified by the Muscle Shoals Board.

3. That all power generated at Muscle Shoals and not reserved for the above purposes be placed at the disposal of the Muscle Shoals Board for assignment to applicants who purpose using it for the manufacture either of fertilizers or of electrochemical and electric furnace products of importance in national preparedness, provided, however, that the Muscle Shoals Board may at any time relinquish control of any portion of the power generated at Muscle Shoals and not in demand for the above-named purposes.

4. That all the power generated at Muscle Shoals be sold at the power plant of the power-generating company and at cost, provided, however, that the Muscle Shoals Board have the authority to fix a lower price on the power delivered to any applicant during his first year of plant operation, the difference in the income from the power in this case to be deducted from the rental required of the lessee of the power properties.

5. That the Muscle Shoals Board be given special powers: (a) As agent of the United States to lease as a whole or in part Nitrate Plants Nos. 1 and 2, except the steam-electric generating plant in Nitrate Plant No. 2, the rentals received to be used for the administration expenses of the Muscle Shoals Board; (b) to sell, subject to the restrictions in regard to Nitrate Plant No. 2, any parts of the several properties under its control; (c) to permit change in the several plants for their improvement or better use, and to permit the construction of an additional plant or plants on the land under its control; (d) to designate the applicants who shall receive the power generated at Muscle Shoals, to fix the amount of power to be delivered to each, and to fix the price at which power is to be sold to any lessee during his first year of plant operation.

MUSCLE SHOALS POWER LEASE

Three specific recommendations of the minority report are (in abbreviated form) as follows:

"1. We recommend that authority be given by Congress to some agent of the United States to lease Wilson Dam and appurtenances, the hydro-electric power generating station thereat and the steam-electric power generating plant at Nitrate Plant No. 2, all for a period not to exceed fifty years and under the terms and conditions outlined below.

"2. We recommend that the lessee be required: (a) To maintain and operate the power plants, using the steam-electric plant as an auxiliary to the hydro-electric; (b) to pay an annual rental equal to 4 per cent of the fair present value of the properties, estimated to be $42,000,000; (c) to deliver the power as directed by the Muscle

Shoals Board, provided that any power not taken under the assignments of the board may be sold by the lessee as hereinafter provided; (d) to construct at his own expense, whenever so directed by the Federal Power Commission, any part or all of a power and storage dam, with the power-generating equipment, either at Cove Creek or at some other site approved by the Federal Power Commission, and to operate this dam so as to give the maximum useful effect at Muscle Shoals; (e) to have the right for a period of two years to construct and operate Dam No. 3 with its power equipment, or, should the United States construct Dam No. 3, to have the right to lease the power at this dam; (f) to make from time to time and at his own expense such additions to the hydro-electric and steam-electric power generating equipment at Muscle Shoals as may be directed by the Federal Power Commission; (g) to sell all power generated at Muscle Shoals at a price schedule agreed upon with the Federal Power Commission, except as otherwise directed by the Muscle Shoals Board, provided that should the lessee be unable to sell at the fixed schedule any of the power not taken under the assignments of the board, then the lessee may sell such power at a less price, approved by the Federal Power Commission, deducting the difference from the rental to be paid the United States.

"3. We recommend that all the power generated at Muscle Shoals be sold at the power generating station and at the same price to all customers, except as above provided; that the price schedule arranged between the lessee and the Federal Power Commission be adjusted triennially and be fixed so as to yield an annual gross income to cover the following: (a) Rental to the United States; (b) a reasonable return on such portions of the required investments of the lessee as, in the judgment of the Federal Power Commission, are properly chargeable to power production at Wilson Dam; (c) all actual operating and maintenance expenses and a fair remuneration; (d) any taxes; (e) reserve funds."

Calls Special Session

Pennsylvania Legislators Summoned by Governor to Consider Giant Power and Other Bills

GIANT power is included by Governor Gifford Pinchot as one of the subjects to be brought before the Pennsylvania Legislature at a special session which he has just called. The members are to assemble in Harrisburg next week. Besides giant power, on which, it will be recalled, the Legislature took no action at its regular session last spring, despite the Governor's urging, the coal strike in the anthracite region, the reorganization of the state banking department and the enforcement of prohibition are included in the matters to be submitted. Governor Pinchot has not yet indicated his course regarding the two members of the Public Service Commission whom he dismissed as indifferent to the public welfare and who were restored to office by the courts.

Detroit Edison and City

Municipal Lighting Commission Report on Relation of Central Station to Municipal Scheme

A REPORT in the form of a letter written by Frank Mistersky, superintendent of the Detroit Public Lighting Commission, to Mayor John Smith includes the information that contracts amounting to more than $10,000,000 have been let in connection with the new municipal power and lighting plant now being built at the foot of Morrell Street. The letter, which had the unanimous approval of the members of the Public Lighting Commission, was in reply to a move on the part of the governmental committee of the Detroit Board of Commerce to curtail construction work on the new municipal plant because of the committee's belief that the proper officials of the Detroit Edison Company and the city of Detroit had not met together for the purpose of discussing the matter of the Edison company furnishing the city with all or a large percentage of the amount of electricity needed.

The chairman of this committee stated as its opinion that if the Detroit Edison Company should now agree to furnish as much as 15 per cent of its total output of electricity to the city, the city should curtail to some extent the project as now contemplated. In reply Mr. Mistersky averred that Smith, Hinchman & Grylls, engineers for the Public Lighting Commission, who were empowered by it to confer with the Detroit Edison Company officials, reported that the Edison company had expressed its unwillingness to carry permanently more than 10,000 kw. of the city's load but temporarily would furnish the city with power for its immediate requirements under virtually all conditions, provided that the city was making a bona-fide effort to obtain a permanent supply which would not come from the company's generators.

It was then decided, the commission reported, to proceed with plans for the construction of a municipal power and lighting plant of such capacity as will light the city's streets and run the street railway department. The initial installation will be, as already reported in these columns, a 60,000-kw. plant. From the progress being made since the first of the year, officials of the commission are hopeful of having one of the plant units in operation by July, 1926.

A. S. M. E. Deals with Industrial Power

Several Subjects of Interest to Electrical Engineers Come Up at Mechanical Men's New York Meeting—Wood Industries Section Discusses Electric Molder

INDUSTRIAL power and heating came in, as usual, for a good share of attention at the annual meeting of the American Society of Mechanical Engineers held in New York City this week. W. H. Larkin, Jr., presented a paper on "The Supply of Industrial Power" in which he discussed the importance of accuracy in making up power costs and warned against probable leaks and inefficiency caused by wasteful methods. He suggested that the advantages and economies of purchased power over private plant operation be carefully studied by all industrial power users. In this connection N. E. Funk of Philadelphia expressed the opinion that nearly always the money invested in a power plant by a manufacturer could much more profitably be invested in other more productive equipment used directly in the process of manufacture.

In a study of industrial furnaces Prof. W. Trinks brought out that too much emphasis has been placed on heat economy, whereas more consideration should be given to the quality of the finished product. This is particularly true of electrically heated furnaces. The actual cost of fuel for heat treating in a manufacturing process is usually only 0.2 per cent to 1 per cent, so that a comparatively small improvement in quality or lowering the number of "rejects" will easily offset any additional cost of heat produced electrically over that produced by other fuels. Shop foremen in charge of heating operations, Mr. Trinks pointed out, are chiefly concerned with methods that will reduce labor cost, decrease spoilage, raise the quality of their finished product and improve working conditions. Electrically heated furnaces have been found to meet all of these requirements more fully than have fuel-fired furnaces.

Electricity in Wood Industries

At the meeting of the Wood Industries Section Andrew Jensen, Jr., presented a paper on "The Electric Molder." The paper and following discussion made a thorough analysis of the power requirements and great production possibilities of the electric machine. Another paper by Charles Fair described the use of frequency changers and high-speed induction motors in obtaining the high speeds necessary in the woodworking industry.

On Thursday the program included papers on "Radiation in Boiler Furnaces," "Recent Developments at Colfax Station," "Steam Bleeding and Turbine Performance," "Development of a Unit Pulverizer" and "Furnace Refractories." Herbert Hoover, Secretary of Commerce, and Past-president W. R. Warner were made honorary members. Mr. Hoover's Henry Robinson Towne lecture on research in pure science is summarized elsewhere in this section. Dr. Zay Jeffries of Cleveland was scheduled to give the Robert Henry Thurston lecture on Friday night.

William L. Abbott, chief operating engineer of the Commonwealth Edison Company, took office as president of the association in succession to William F. Durand.

Rocky Mountain N. E. L. A. Will Confer at Idaho Springs

Decision has just been made by the executive committee of the Rocky Mountain N. E. L. A. to hold a section and committee conference at the Hot Springs Hotel, Idaho Springs, Col., on December 14 and 15. This will take the place of the annual one-day midwinter meeting usually held in Denver in conjunction with state associations and the Committee on Public Utility Information. The purpose of the meeting is to formulate plans and policies and also to arrange consecutive committee sessions for central-station representatives interested in each major activity. The commercial program will be emphasized. Plans for the conference are being arranged by section committee chairmen and O. A. Weller, division secretary, Public Service Company of Colorado, Denver, with whom reservations should be made.

Public Ownership on Upper Tennessee Agitated

The executive secretary of the Federal Power Commission and the Chief of Engineers have declined to cancel or postpone the hearing set for December 15 in Chattanooga to consider applications for sites on the upper Tennessee River. They have been importuned to defer the hearing by members of the Senate and the House of Representatives and by state officials, but the federal officials point out that no action of any kind can be taken at this hearing, which is intended only to collect information concerning the projects.

Apparently there are some in Tennessee who would have the state embark in the power business in much the same way as Arizona is proposing to do on the Colorado. Demand that the state participate in the development of its water power has been sufficiently strong, it is said, to lead the candidates in the forthcoming gubernatorial race to commit themselves to some form of state ownership and operation.

Virginia Utility Men Discuss Rural Service and Lighting

Problems of highway lighting in unincorporated communities and other matters connected with rural service formed a leading subject of discussion by the sixty Virginia utility men who assembled at the Jefferson Hotel, Richmond, on November 20-21, for the convention of the Public Utilities Association of that state. The activities of the Virginia Committee on the Relation of Electricity to Agriculture, which is under the guidance of C. E. Seitz, of the Virginia Polytechnic Institute, were heartily indorsed.

Among the topics of addresses made before the convention were: "Public Service Today and Tomorrow," by Alex Forward, secretary American Gas Association; "Virginia's Opportunity," by J. R. Horsley, chairman Virginia Water Power Commission; "Responsibility," by Warren R. Voorhis, vice-president American Waterworks & Electric Company; "The Utilities' Part in Unifying Virginia's Industrial Opportunities," by W. E. Wood, vice-president Virginia Electric & Power Company, and "Customer Ownership," by C. E. Robertson, manager investment department Virginia - Western Power Company. Governor Trinkle and other prominent men addressed a well-attended banquet.

A legislative committee was appointed to co-operate with the Virginia Water, Power and Development Commission. Floyd W. King of the Virginia - Western Power Company, Clifton Forge, was re-elected president. W. E. Wood, R. Gray Williams and B. B. Furgesson will be vice-presidents and H. C. Bradshaw secretary-treasurer.

Florida Floods Do Little Harm to Central-Station Plants

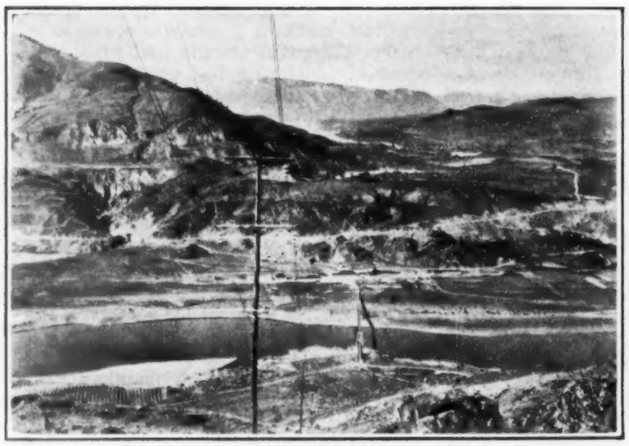
Floods in Florida cities occasioned by a torrential downpour of rain last Sunday night caused inconvenience to electric light and power companies in various places, but not apparently to the extent implied in newspaper dispatches. In Miami, where 14 inches of rain fell in twelve hours, the plant of the Miami Electric Light & Power Company was, according to advices received at New York headquarters, at no time forced to shut down completely, though service in some sections of the city was suspended for a few hours owing to the flooding of the generator room. At Tampa, where the wind attained a great velocity though comparatively little rain fell, distribution lines went down and street cars stopped running, but the power plant was uninjured and service was quickly restored.

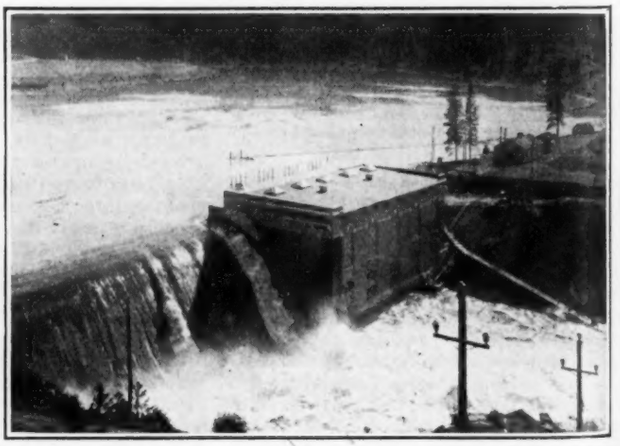
Service Begun Over 110-Kv. Line in North Georgia

Service on the Toccoa-Augusta 110,000-volt transmission line built across north Georgia by the East Georgia Power Company, a subsidiary of the Georgia Railway & Power Company, has begun, and energy for light and power service in Augusta and for operating the street railway there is being brought from the Georgia Railway & Power Company's hydro-electric plants.

The line, which opens up a new territory to electrical development, is built on steel towers. It connects the Toccoa substation with the Stevens Creek plant of the Augusta-Aiken Railway & Electric Company, just outside the Augusta city limits. On the line, which is 104½ miles long, there are 913 steel and concrete towers. In building it it was necessary to cut a swath 100 ft. wide through approximately 63 miles of heavy timber.

Recent Plans and Acquisitions of Washington Water Power Company





DEVELOPMENT of the Chelan River project in central Washington by the Washington Water Power Company of Spokane in the near future is now assured, it being thought that 75,000 hp. will be produced, the plant to cost $10,000,000. The left-hand picture shows the Columbia River in the foreground. The Chelan River originates at Lake Chelan, seen in the background, and flows about 4 miles to the Columbia, providing a head of more than 300 ft. The town of Chelan is seen at the foot of the lake and the Cascade Mountains are in the background. The present 60,000-volt transmission line of the company is seen descending the Columbia River gorge. This line connects the general system of the company with the Okanogan properties which it purchased two years ago.

The right-hand picture is a view of the Nine-Mile power station recently purchased by the company. (See ELECTRICAL WORLD for September 19, page 577.)

New York Central to Spend $30,000,000 to Electrify

Thirty million dollars will, the New York Central Railroad announces, be spent on the electrification of its west side lines in New York City according to the plan already briefly reported in these columns. A substation will be built at 158th Street and another at Seventy-second Street, and the installations at the main generating stations in Yonkers and Port Morris will be increased.

The new equipment to be purchased will consist of thirty-three electric road locomotives, thirteen electric switch engines and probably twenty-eight of the new Diesel oil-electric type. Of these only the oil-electrics will be operated below Seventy-second Street. The power north from Seventy-second Street will be furnished by a third-rail contact.

The railroad engineering department has stated that within three years, if no legal or other interruptions interfere, the whole task can be completed. Except for the grade occupation of streets by railroad tracks below Sixty-first Street, the west side question will then have been disposed of. This statement applies especially to the Riverside Park section of the city.

It is estimated that the electrification itself, including new equipment, will cost somewhere in the neighborhood of $27,000,000, and this figure, together with the cost of a new viaduct to eliminate grade crossings, will carry the total cost of the work well over the thirty-million mark.

Secretary Hoover on Progress in Eliminating Waste

"One of the most astonishing transformations in economic history" is the phrase in which Secretary of Commerce Hoover, in his annual report to Congress, sums up the progress made by the United States during the last five years in the elimination of waste on a national scale.

"That movement," he says, "is the result of a realization by every group —business men, industrial leaders, engineers and workers—of the fundamental importance of this business of waste elimination. In addition to elimination of waste we have had the benefit of notable advances in science, improvement in methods of management and prohibition."

The fundamental purposes of the campaign, Secretary Hoover says, are to maintain American standards of living for workers and farmers and to place production on a more stable footing. The activity of the Department of Commerce in this field of waste elimination is indicated by the fact that since the work was launched on a large scale in 1921 about nine hundred group conferences have been held under the auspices of the department, virtually all at the request of the industries themselves, while upward of two hundred committees are now at work in co-operation with the department on various phases of the program.

Paul S. Clapp, special assistant to the Secretary, contributes a portion of the report and, among other things, describes "elimination of waste through enlarged electrification," of which he says:

"During the past five years there has been a notable advance in the electrification of the country and in the generation and distribution of power. This is being accomplished not only with an enormous saving in fuel but with large increases in productivity, reduction of physical effort and labor, and added comfort in the home. Since 1920 long strides forward have been taken in the development of widespread electrical power systems, which are increasingly becoming the enormous reservoirs of mobile and reliable power for all purposes, upon which in such large measure our national progress depends. The cost of power has been maintained at pre-war levels, the large economies in production and distribution offsetting the rise in labor and material costs."

Bureau of Standards' Electrical Research Work

With reference to the work of the Bureau of Standards during the last fiscal year, Dr. George K. Burgess, the director, points out in his annual report that 171,000 items were tested to determine the merits and properties of materials and products. In addition, thousands of samples of miscellaneous materials were tested, control tests were made on imports of sugar on which $136,000,000 in duties was collected, and the bureau prepared and distributed more than 5,000 standard samples of certified chemical analyses. The bureau avoids carefully, Dr. Burgess declares, any competition with private laboratories. In the case of some materials the testing is done by the bureau because commercial laboratories have failed to agree on the analysis. Most of the industrial research of the bureau is carried out in co-operation with technical societies and manufacturers' associations, under the direction of committees on which all interested are represented.

To keep pace with the demands of the electrical industry the bureau is extending its facilities to measure potentials as high as 350,000 volts, an undreamed-of voltage only a few years ago. Other work in the field of electricity comprises a considerable number of tests on various types of electric batteries, especially primary batteries for operating railway signals, storage batteries for automobiles and dry batteries. The circulation of a warning concerning the use of so-called "patent electrolytes" in storage batteries is another important move on the bureau's part to safeguard the public's interests. Samples representing purchases of more than 1,500,000 electric lamps by the government were tested by the bureau during the year. In the radio field special mention is made of the transmission of standard frequency signals and the development of improved frequency meters.

Thirty-five simplified practice recommendations have now been accepted, covering a great variety of commodities. Many more are in process of acceptance, and surveys are in progress in many additional fields. The leaders in nine industries which have put simplified practice recommendations into effect estimate a saving of nearly $294,000,000 through this work.

Discussing the needs of the bureau as disclosed by the rapidly increasing use of its facilities by both public and private institutions, Dr. Burgess points out that a new central power plant is urgently needed, as well as more adequate support for many lines of work of importance.

Technical Men to Hold Fuel and Power Meeting

The conservation of fuel through more efficient utilization will be discussed in Huntington Hall, Boston, December 10 and 11, under the auspices of the Affiliated Technical Societies of Boston. Prominent engineers will take part. The program follows:

Thursday, December 10.—Morning: Chairman, Dr. Ira N. Hollis. "Sources and Utilization of Coal," F. H. Daniels, Worcester; "Sources and Utilization of Oil," E. H. Peabody, New York; "Diesel Engines," J. F. Hecking, Cambridge, Mass.; "Possibilities of Obtaining Power from Public Utilities," L. R. Nash, Boston.

Afternoon: Chairman, Dr. S. W. Stratton. "Power for Textile Mills," Charles T. Main, Boston; "Power for Paper Mills," Joseph Warren, Cumberland Mills, Me.; "Power for Industries Using Relatively Little Power," K. D. Hamilton, Brockton.

Friday, December 11.—Morning: Chairman, I. E. Moultrop. "Advantages and Disadvantages of High Steam Pressures," Joseph Pope, Boston; "Utilization of Extraction Steam," Edgar A. Dickinson, Lynn, Mass.

Afternoon: Chairman, F. M. Gibson. "The Supply of Industrial Power," W. H. Larkin, Jr., United States Rubber Company, Passaic, N. J. (followed by round-table discussion).

On Friday evening, at 6:30 o'clock, there will be a dinner in the new Chamber of Commerce Building. E. C. Hultman, vice-chairman New England Governors' Committee, will speak on the coal situation, and H. R. Linn, American Radiator Company, Chicago, on "Household Heating."

Skagit Engineering Commission's Quarter-Century Plan

Proposing a program of gradual development by which a hydro-electric plant of 267,000 kw. rating would be built up by 1951, at an estimated outlay of $28,550,000, the Skagit Engineering Commission, composed of Joseph Jacobs, W. Chester Morse and Sterling B. Hill, has filed its report with the City Council of Seattle. The commission holds that a three-plant development on the Skagit River contemplating the construction of power houses at Gorge, Diablo and Ripraps or Ruby is more desirable than a two-plant development contemplating the construction of power houses at only Gorge and Diablo. It expresses the opinion that the next major development on Skagit River should be a concrete masonry dam at Diablo Canyon built to a crest of 1,200 ft.

As a program for 1926 the commission recommends that the Seattle-

Tacoma tie line be changed to a potential of 110,000 volts and its capacity increased to 45,000 kw., at an estimated cost of $200,000; that a third unit of 20,000 hp. be installed at the Gorge plant, at an estimated cost of $550,000, and that $100,000 be spent in raising the crib dam at the Gorge plant and other changes necessary to improve operating conditions. The initial construction of the Diablo power house in 1930, with subsequent expansion, is recommended, the Ripraps plant being postponed to 1943. Superintendent Ross' recommendations were published in the ELECTRICAL WORLD for November 21, page 1069.

Briefer News

Puget Sound Company Buys Sequim (Wash.) Plant.—The Sequim (Wash.) Light & Power Company has sold its plant and franchise to the Puget Sound Power & Light Company for the sum of $80,000.

Utah Power & Light Adds a Steam Plant to Its System.—The steam electric plant and distribution system of the Green River Electric Light & Power Company at Green River, Wyo., has been purchased by the Utah Power & Light Company. Approximately six hundred customers are now receiving service from this plant.

Four Ohio Utilities Merged.—The Southern Ohio Electric Company has acquired the Hocking Power Company of Nelsonville, Ohio; the Mutual Electric Company of Middleport, and the Southern Ohio Power Company of Floodwood, the combined valuation being placed at about $3,500,000.

Commonwealth Edison Will Broadcast by Radio.—The Commonwealth Edison Company has joined the central-station companies which broadcast radio programs and will, until it can acquire a permanent station, utilize eleven hours every week in sending out high-grade numbers from the Westinghouse studio (KYW) in the Edison Building.

Young to Address American Farm Bureau Federation.—A thirty-minute address on "Making the Load Lighter by Electricity," by Owen D. Young, chairman of the General Electric directors, is scheduled by the American Farm Bureau Federation as part of the program for the session of its seventh annual meeting to be held on Monday evening, December 7, at the Sherman Hotel, Chicago.

Former Municipal-Plant Town Expresses Satisfaction with Central-Station Service.—Officials of the Community Power & Light Company of St. Louis and of its operating subsidiaries, the Texas Utilities Company and the New Mexico Utilities Company, recently made a tour of the region served by them in the Southwest, where the extensions of their companies include the acquisition of the municipal plants at Clovis and Portales, N. M. A banquet at the former city was the occasion for the expression of appreciation by prominent citizens concerning the plans of the companies for electrical development there.

Fire Causes Shutdown of Canadian Plant.—A brief but disastrous fire in the power house of the Dominion Power & Transmission Company at Decew Falls, near St. Catharines, Ontario, threw homes in St. Catharines, Welland and Port Colborne into darkness for many hours. Although the damage is placed at only about $50,000, many factories and other places dependent upon the Dominion Power company's service were compelled to close down.

Southern Power Company May Take Over Municipal Plant.—Negotiations are under way between the Mount Airy Water and Light Commission and the Southern Power Company to have that company take over the two hydro-electric plants belonging to Mount Airy and furnish power and light there. If an agreement is reached, the matter will be submitted to the voters. Mount Airy has a population of about 5,000.

Kentucky Utilities Company Acquires an Indiana Property.—It is reported that the Kentucky Utilities Company of Louisville has purchased the Cannelton (Ind.) Electric Light & Power Company's properties, which were under lease to the municipality. They will be turned over to the new owner as soon as the deal is approved by the state Public Service Commission, and to operate them a new company, to be known as the Ohio River Power Company, will be incorporated with a capital of $100,000.

Seminole Power Company Contemplates Large Hydro Plant in Wyoming.—The Seminole Power Company has a permit from the Wyoming State Engineer for the construction of a hydro-electric plant on the North Platte River, about 40 miles north of Fort Steele, Wyo. The project involves a dam 150 ft. high, a reservoir containing 700,000 acre-feet of water and a 2-mile tunnel to a site at which 50,000 hp. may be developed. This project has been in abeyance for some years, but now early construction is said to be under contemplation.

Murfreesboro (Tenn.) Plant Sold to Tennessee Electric Power Company.—The Tennessee Electric Power Company has purchased the Murfreesboro (Tenn.) Light & Power Company at a cash consideration of $700,000 and will take over operation of the plant on April 1. The local company has a hydro-electric plant at Walter Hill, 8 miles north of the city. It has, besides, purchased power from the Tennessee Electric. Extensions of the latter's transmission lines are promised.

Des Moines Electric Company Expanding.—The Des Moines Electric Light Company has purchased the lighting systems in Altoona and Mitchellville from the Hall Electric Company of Glidden, Iowa. The Des Moines company is now serving from its new plant a chain of cities which includes the Ataloosa group of eight municipalities, Adel and ten surrounding towns and Colfax, Altoona and Mitchellville. Extensive improvements and extensions are planned for the whole group.

Nashville Railway & Light's Budget for 1926.—More than $1,500,000 is to be expended by the Nashville Railway & Light Company next year. The budget officially adopted includes $500,000 for a 20,000-kw. turbo-generator, which will increase the capacity of the power plant 65 per cent,—and $100,000 for an outdoor substation to be erected opposite the First Avenue power house. The total sum, a large part of which is allocated to the railway department, is more than twice that appropriated for 1925.

More Consolidation in Ohio.—The Republic Railway & Light Company, holding company for the Penn-Ohio Edison Company and Pennsylvania-Ohio Power & Light Company, has purchased for cash the Northeastern Ohio Power & Light Company, the Grand River Electric Light & Power Company and the Suburban Utilities Company. The newly acquired properties operate in a territory extending east and west from Ashtabula along the shore of Lake Erie. They will complete a corridor from the new plant at Toronto, on the Ohio River, northward 100 miles through Youngstown to Lake Erie.

Electrical Progress in Dallas.—Work on the additional 20,000-kw. generating unit for the Dallas Power & Light Company, previously announced as in contemplation, is to start about January 1. This unit will, it is estimated, cost $2,500,000. Downtown Dallas will soon have the advantage of the underground alternating-current network protector system which has been in process of installation during a period of two years, at a cost exceeding $2,000,000. This will make possible the pooling of energy over the downtown area and assure continuity of service even if trouble occurs on one or two of the five main feeder cables.

Hamlet's Home Town Now Terminus of International Power Cable.—The great submarine power cable stretching under the Baltic Sea from Helsingfors, Sweden, to Elsinore, Denmark, has been finished and will be operated at 50,000 volts from the River Lagan, in southwestern Sweden, to Copenhagen, the Danish capital, where it is used by utility companies and factories. The entire countryside about Copenhagen will, it is said, be lighted by Swedish power, and plans are being considered for extension of this service to other European countries.

Santa Barbara Service Interrupted.—Forest fires in the mountains between Casitas Pass and Ojai, about 5 miles south of Santa Barbara, caused an interruption of several hours' duration to the electrical service of that city on November 20. Two 60,000-volt transmission lines of the Southern California Edison Company supply the electrical energy for the city. One of these,

a wooden-pole line from Castaic substation, was so badly burned that it will be necessary to rebuild several sections. The other, a steel-tower line from Saticay substation, was not seriously damaged, although some of the insulators were broken down and in a few places the conductor was severed by the extreme heat.

Two Illinois Electrical Utilities Change Hands.—The Illinois Commerce Commission has authorized the purchase by the Central Illinois Public Service Company of the Wabash Utilities Company, owning electric utilities in Lawrence and Crawford Counties, at a price of $102,866, and the Marshall Ice & Power Company for $50,000 cash and fifty shares of preferred stock.

Industrial Electric Heating School at Indianapolis Well Attended.—The industrial electric heating school held in Indianapolis on November 17-19 claims the distinction of having the largest attendance registered at any such meeting yet held. Fifty-seven men were present. It was held under the auspices of the industrial heating committee of the Indiana Electric Light Association, of which J. E. Nelson, engineer of the Merchants' Heat & Light Company, is chairman, and was conducted by W. S. Scott of the Westinghouse Electric & Manufacturing Company, through the co-operation of the industrial heating committee of the National Electric Light Association, of which he is chairman. Practical inspection trips to representative heating installations in the city were arranged for each day.

Long Span Across Narrows Completed.—What is said to be the longest transmission span in the world has been completed across Puget Sound at the Narrows in connection with the Cushman hydro-electric project of the city of Tacoma, Wash. The span is 6,240 ft. between supports and consists of six plow-steel cables each of which weighs 11 tons. A 24-ton pull was necessary to bring the conductors to the required tension to give a minimum clearance of 220 ft. above the water. The six cables will form a part of the two 110-kv. circuits between the Cushman project and the city of Tacoma. The Cushman development is well along, and it is expected to have the 40,000-kva. plant in operation some time during the spring of 1926. A civic celebration, probably lasting for several days, is planned by Tacoma to mark the completion of the plant.

Columbia Power Company's New Cincinnati Station to Be Dedicated Next Week.—Thursday, December 10, has finally been set as the date of dedication for the new Columbia power station of the Union Gas & Electric Company of Cincinnati. Owen D. Young, chairman of the General Electric Company's board of directors, will be the principal speaker at a banquet at the Sinton Hotel on that date. Others who will speak are Philip O. Geier, president of the Cincinnati Chamber of Commerce; Philip G. Gossler president Columbia Gas & Electric Company, and W. W. Freeman, president of the Union Gas & Electric Company. On December 11 and 13 the station, now to be known as Columbia Park instead of Fort Miami, will be open for inspection by the general public. Thousands of visitors are expected. The initial capacity of the new station is 90,000 kw.

Aylesworth to Address Boston Electrical Men.—M. H. Aylesworth, managing director National Electric Light Association, will address the Metropolitan Electrical League of Boston at a luncheon meeting December 11, at 12:30 p.m., in the new Chamber of Commerce Building, upon "The Present Situation in the Electrical Industry."

Industrial Factor to Enter Power Field in St. Louis.—A new factor in the electric power field in the St. Louis territory is foreshadowed in the announcement that the Midland Coke & Iron Corporation has let contracts for the construction of a 10,000-kw. power plant in conjunction with a new blast furnace at Granite City, Ill. The Midland Coke & Iron Corporation on November 16 took over the property and business of the St. Louis Coke & Iron Company, which had purchased its power from the Union Electric Light & Power Company of St. Louis. It is asserted that the new power plant, for which machinery contracts have been let, will furnish all the power required by the big coke plant and have a surplus for distribution and sale outside. The power plant will have two units of 5,000 kw. each and will use coke-oven gas for fuel.

Pacific Gas & Electric to Build Diversion Dam for Future Pit River Plant.—Work is to be started at once on the diversion dam and intake for the Pit No. 4 hydro-electric development of the Pacific Gas & Electric Company. A 40-ft. dam is to be built 1½ miles downstream from Pit No. 3, which was placed in operation July last. This will create an afterbay of 1,550 acre-ft. storage capacity below Pit No. 3, which will permit peaking at the Pit No. 3 plant and still maintain the required constant flow of the Pit River below the power sites. The work now to be done involves an expenditure of approximately $1,750,000, while the estimated cost of the entire Pit No. 4 development is $14,500,000. Four out of a series of eight plants to be built by the Pacific Gas & Electric Company on the Pit River in northern California, at a cost of over $100,000,000, are now completed and in operation, with a total installed capacity of 175,000 kva. Pit No. 4 will add to this another 100,000 kva.

Helena Railway & Light in Receiver's Hands.—With first mortgage bonds in the amount of $894,000 due September 30 and unpaid, the Helena (Mont.) Railway & Light Company has been forced into the hands of a receiver by petition of the general creditors. This mortgage covers the entire property of the company, including a railway property that has been unproductive for some time. It is understood that the principal reason the company was unable to refinance its mortgage on the maturity of its bonds was that the bond issue represented too large a proportion of the productive property, consisting of the electric and gas systems. Further hampering any possible financing at that time was the circumstance that the company faced damage suits amounting to $150,000 arising out of a wreck last December. A. T. Schultz, formerly manager of the company, has been appointed receiver and continues in charge. Bondholders are suing to foreclose the mortgage and have the receivership consolidated.

Agricultural Engineers Again to Take up Rural Electrification.—The North Atlantic Section of the American Society of Agricultural Engineers will hold a meeting at the Hotel Van Curler, Schenectady, December 10, 11 and 12 which will be devoted in part to electrification. An address on this subject will be made by a prominent state official of either New York or Pennsylvania. Co-operative relations between farmers, electric power companies and manufacturers of equipment will be the subject of a paper by C. E. Seitz, professor of agricultural engineering at the Virginia Polytechnic Institute. H. W. Riley, professor of rural engineering, Cornell University, will discuss rural electrification from the viewpoint of the agricultural college; C. H. Churchill of the Adirondack Power & Light Company will discuss the subject from the viewpoint of the power company, and W. T. Ackerman of the University of New Hampshire from the standpoint of the rural electrification experimental project. A paper on electric lighting on the farm will be presented by A. D. Bell of the Edison Lamp Works of the General Electric Company.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

American Society of Agricultural Engineers, North Atlantic Section—Schenectady, N. Y., Dec. 10-12. Raymond Olney, St. Joseph, Mich.

American Physical Society—Kansas City, Dec. 28-30. H. W. Webb, Columbia University, New York.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Jan. 15. E. F. Kelley, Louisville Railway Co., Louisville.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—New York, Feb. 8-12. F. L. Hutchinson, 33 West 39th St., New York.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

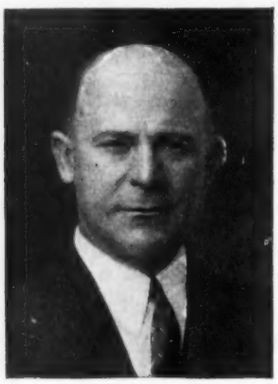
Southwestern Geographic Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Men of the Industry

G. P. Baldwin New Vice-President of General Electric Company

George P. Baldwin, who was elected a vice-president of the General Electric Company at a meeting of the executive committee on November 20, as announced in last week's issue of the ELECTRICAL WORLD, is a native of California and a graduate of Leland Stanford University. In 1897 he entered the employ of the Stanley Electric Manufacturing Company, which in 1903



G. P. BALDWIN

was bought by the General Electric Company. At that time Mr. Baldwin became vice-president of the Blaisdell Company of Los Angeles, where he remained until March, 1910, when he was made manager of the Pittsburgh office of the General Electric Company. In December, 1915, he was made manager of the Atlantic district, with headquarters in Philadelphia. When the merchandising department was created in 1923 he was made its first manager.

Charles E. Patterson, who succeeds Mr. Baldwin as general merchandising manager, has been vice-president of the company in charge of finance since 1920. A native of New York City and a graduate of Princeton University, he was associated with the New York Central Railroad and the American Locomotive Company before entering he employ of the General Electric Company in 1909.

R. E. Moses of Oswego, N. Y., who was reported in the November 21 issue of the ELECTRICAL WORLD to have been appointed to the general managership of the Sayre (Pa.) Electric Company, has not been appointed to that office, according to a statement received from Mr. Moses. St. Clair Murray, whom Mr. Moses was reported to be succeeding, has not been transferred to Binghamton (N. Y.), as previously announced.

Henry Grenacher has been appointed assistant general manager in charge of operation of the Northern States Power Company at Minneapolis, according to an announcement made by Halford Erickson, vice-president in charge of operation of the Byllesby Engineering & Management Corporation. Mr. Grenacher, who has been associated with the Byllesby Engineering & Management Corporation since 1909, is assuming the position made vacant by the transfer of H. H. Jones, who, as announced in last week's issue of the ELECTRICAL WORLD, has been elected vice-president and general manager of the Western States Gas & Electric Company and vice-president of the California-Oregon Power Company.

Carl M. Einhart has resigned as president and general manager of the Southwestern Public Service Company, of which he has been the official head since the consolidation of various public utilities in Texas, New Mexico and Arizona under that name. When the Roswell Public Service Company was sold to the Southwestern Public Service Company all his financial interests in the old company were disposed of. When Mr. Einhart became manager of the old Roswell Gas & Electric Company it was a small utility with inadequate equipment. During the years of his managership the business of the company was built up very greatly, and when finally he became a large stockholder in the company and reorganized it under the name of the Roswell Public Service Company further improvements were made. Mr. Einhart had managerial supervision over the Southwestern properties in Roswell, Artesia, Dexter, Hagerman, Greenfield, Lake Arthur, Carlsbad, Otis, Loving, Amarillo, Panhandle, Pampa, Flagstaff, Winslow and Holbrook.

C. Stark Sales Manager of Erie Iron Company

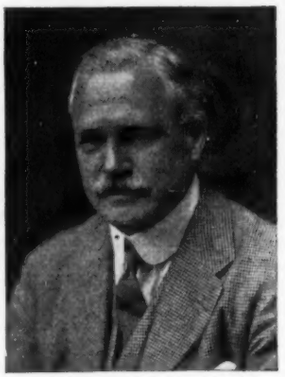
Clinton Stark has resigned from the Westinghouse Commercial Investment Company to become sales manager of the Erie Malleable Iron Company, with offices in Erie, Pa. Mr. Stark will be

CLINTON STARK

engaged chiefly in promoting the expansion of that organization's new "Kondu" line of threadless fittings. He was formerly connected with the Sprague Works of the General Electric Company as manager of supply sales. During an affiliation with the electrical jobbing industry that has covered a period of many years Mr. Stark has built up a reputation as the originator of effective administrative policies.

J. M. Wakeman to Return to United States

James M. Wakeman, his many friends in the electrical industry will be delighted to know, is on his way back to the United States after an absence of sixteen months. Most of that time was spent in England, Scotland, France and Italy. Mr. Wakeman sails from Liverpool on the S.S. *Baltic* on December 5 and will be at the Hotel Alvord,



J. M. WAKEMAN

East Orange, N. J., after his arrival in this country. As is well known, Mr. Wakeman, who was for many years associated with the ELECTRICAL WORLD as vice-president and general manager, retired in 1910 in quest of health and after an absence of thirty months took up active work again in 1913 as general manager of the Society for Electrical Development, which was then organized. He severed his connection with the S. E. D. on May 10, 1921, and since then has been traveling extensively in Europe except for a visit to this country in 1922.

George Allen of New York has been elected president of the Duke-Price Power Company, Ltd., to succeed the late James B. Duke.

E. K. Karcher has been appointed acting chief electrical engineer of the Utica Gas & Electric Company. Mr. Karcher has been associated with the Utica utility as electrical engineer since 1920.

Obituary

Henry Hine, president and general manager of the Guanajuato Power & Electric Company, Guanajuato, Mexico, died of pneumonia November 22 at his home in New York City following a brief illness. Mr. Hine was formerly manager of the Stanley Electric Manufacturing Company of Pittsfield, Mass., which he joined in 1891, remaining a number of years, when he was forced to go to Colorado for his health. Later he went to Mexico.

Commission Rulings

Revocation of Franchise Does Not Warrant Commission in Rescinding Approval of Stock Issue.—Subsequent to the approval by the New Jersey Board of Public Utility Commissioners of a stock issue by the Landisville Electric Company, the franchise of that company was revoked by the municipal authorities on the ground that its conditions had not been fulfilled. A petition was thereupon filed asking the commission to rescind its approval of the stock issue, but this the commission refused to do on the showing, though it left the way open for the renewal of the application in case service from the plant was not rendered.

Holding Company Which Supplies Commodity Is Subject to Regulation—Interstate Traffic.—Two questions came before the Montana Railroad and Public Service Commission in connection with the sale by the Gallatin Natural Gas Company, an outside concern, to the Billings Gas Company of natural gas for distribution in Billings. The Gallatin Natural Gas Company maintained that it was not a public utility and that it was outside the commission's jurisdiction. The commission found that since the Gallatin company admittedly "owns and controls, or owns and can therefore control," the Billings company, the latter, because of this corporate identity, is merely the *alter ego* of the former. With respect to the interstate character of the Gallatin company, the commission cited the opinion of the United States Supreme Court in the Pennsylvania Gas Company case, wherein it was held that while the transmission and sale of natural gas produced in one state, transported by means of pipe lines and directly furnished to consumers in another state, is interstate commerce, nevertheless it is local in its nature, and the sale of gas by the company to local consumers who are reached by the use of the streets of the city in which the pipes are laid and through which the gas is conducted to factories and residents as it is required for use is local and consequently may be regulated by local authority.

Defense of Consolidations with Proper Limitation of Capital Accounts.—In granting authority to the Mohawk-Hudson Power Company to acquire stock in and consolidate certain electric and gas companies, the New York Public Service Commission made the following defense of such mergers: "The commission feels that the action proposed by the petitioner herein will be in the public interest for reasons which may be summarized briefly as follows: It will allow greater conservation of resources, greater utilization of waste power and potential power and a greater use of existing facilities. It will avoid duplication of generative and transmission facilities, consequently saving capital expenditures and the accompanying operating costs. It will permit of a more comprehensive plan of financing and will make financing of hitherto undeveloped resources practicable and economical. It is believed that the proposed plan applies to a larger area and to communities having a diversity of electrical requirements the same principles which have demonstrated that central facilities are better and cheaper than isolated plants for each group of users. Bearing in mind that the commission's authority and jurisdiction over holding companies is limited and that this petition may be granted under conditions which are deemed to be wise and proper in the public interest, the commission has provided in its order, as a condition of the granting of these applications, that the stated capital accounts representing the securities issued by the holding company for the purpose of acquiring the securities of the underlying companies shall in no event exceed the book value of the securities so acquired as shown by the books of the companies whose securities are to be acquired."

Recent Court Decisions

Responsibility of Company for Servant's Act.—The Supreme Court of Appeals of Virginia has reversed a judgment awarding the plaintiff in Robertson vs. Appalachian Power Company damages for injuries received when his horse ran away on account of fright caused by an employee of the power company endeavoring with the help of Robertson to raise wires lying across the road over the horse's head so that the animal would not pull a wagon over them. The higher court found that the employee, a laborer, had no orders or duties in connection with the wires and that the company was not responsible for what he said or did about them. (129 S. E. 224.)*

Public Utility Cannot by Special Contracts Avoid Control of Commission.—The Eagle-Picher Lead Company and other industrial corporations proceeded against the Henryetta Gas Company to prevent that company from charging rates allowed it by the Oklahoma Corporation Commission in excess of those named in special contracts which the corporations held did not come under the jurisdiction of the commission. The Supreme Court of Oklahoma, declaring that no concern can be partly a public utility and partly not, held that the companies suing could not escape the jurisdiction of the Corporation Commission by entering into contracts with private manufacturing enterprises to sell them gas at a reduced price upon the theory that the gas so provided is surplus and in excess of the amount necessary to supply the demands of the domestic customers. (239 Pac. 890.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Flood Waters Not to Be Deflected on Another's Property. — The United States District Court for the Third Division of Kansas found in Bellah vs. Phœnix Utilities Company that the defendant company was without legal right to throw back the flood waters of a river on the premises of plaintiff by building an embankment in such a manner as to impound the water on plaintiff's land and to deflect the current of the stream over it, irrespective of whether the flood waters of the river constituted surface water or were a part of a natural watercourse. (7 Fed. (2d) 406.)

Burden of Proof that Rate Fixed by Commission Is Unfair Rests on Company.—Once more affirming that both original cost and present reproduction cost less depreciation, together with every other factor bearing upon the matter, must be considered in evaluating public utility property, the Supreme Court of Oklahoma, in Western Oklahoma Gas & Fuel Company vs. State, held that the presumption was that the commission in fixing a rate acted fairly and in accordance with the above principle, that the burden of proof to the contrary was on the company, and that, the evidence showing a reasonable net return on the investment, the court could not disturb the commission's findings on property value. (239 Pac. 588.)

Ohio Law Governing Franchise in Which No Duration Period Is Set.—Where the contract between a municipal corporation and an electric lighting company is silent as to the duration of the franchise, declared the Supreme Court of Ohio in affirming a judgment for the plaintiff in State vs. Ohio Public Service Company, such franchise is not perpetual, but the duration thereof is simply indeterminate, existing only so long as the parties mutually agree thereto. A municipal corporation may therefore voluntarily terminate its obligation under the contract and wholly withdraw therefrom. The suit was one begun to oust the defendant from the streets of the village of Orrville, where it had poles, wires and electrical equipment. (149 N. E. 129.)

Increase of Rates Named in Contract Upset.—Five years ago, when the Tennessee Electric Power Company filed with the commission in Nashville a schedule asking an increase in its contract rates with various customers, the Ducktown Sulphur, Copper & Iron Company obtained a temporary injunction against the enforcement of the new rates, the difference to be covered by a bond to insure payment if the case should go against the industrial company. The United States District Court has finally decided in favor of the plaintiff, which is not only exempted from the payment of $80,000 with interest, the amount in dispute since court action was taken, but is also awarded about $10,000 as a refund of the amount paid the power company in the early stages of the controversy over rates.

Manufacturing and Markets

Greater Utilization of Electric Service

Industrial Lighting Campaign Typical Example of Opportunity for Manufacturers to Co-operate

BY A SUPPLY MANUFACTURER

WHEN a manufacturer seizes an opportunity to encourage the use of other electrical products than those he makes by supporting activities that increase the utilization of electrical service he is not only doing for the industry something that is bound to result in more business for himself but is setting an example for other manufacturers. When an industrial customer is induced to extend his use of electric service his decision is generally a composite of impressions received from many different sources. Such customers are generally very favorably influenced by arguments advanced by manufacturers who have nothing at stake in the particular matter in hand. This should be reason enough why every manufacturer with the proper *esprit de corps* should be on the lookout for opportunities to boost the business of other manufacturers of electrical products. But there is another and perhaps more impressive reason for such a policy, namely, to encourage in every way the broader use of electric service, thus inevitably creating a demand for electrical products of virtually every kind. It is the old story of the pebble dropped in the pool. The ever-widening circles of influence will finally embrace the whole range of associated enterprises.

AN ILLUSTRATION OF THE PRINCIPLE

The present industrial lighting campaign, sponsored by the National Electric Light Association and supported by the majority of central-station companies and many electrical manufacturers, is a timely illustration of the principle involved. When the subject of industrial lighting is mentioned one is inclined to think first of electric lamps and reflectors and then to skip to the central station, which may be expected to encourage an increase in its lighting load and revenue from industrial lighting activity. For the manufacturer of equipment other than lamp sockets and reflectors there might appear to be little to justify an interest in such an activity. However, in the case of industrial lighting, for every dollar that is spent in lamps, reflectors and sockets, three dollars may be spent in additional interior wiring, switches and wiring supplies and a like amount in transformers, transmission-line equipment and generating equipment. Although not every job that calls for $100 in additional lamps and reflectors will also call for $600 in new wiring and distribution equipment, because many wired installations are adequate for considerable increases in the connected lighting load, no material increase in the lighting installation or improvement in the lighting distribution can be effected without some incidental expense for wiring. In those cases where rewiring is necessary the expense for materials involved will be several times the expense for lighting equipment proper.

Because manufacturers of wiring material and incidental supplies are in a position to profit more for the dollar spent than the manufacturers of lighting equipment, it should be apparent that manufacturers of these allied lines should not only be interested in the spread of the gospel of better industrial lighting, but should pass up no opportunity to speak a good word for manufacturers of lighting equipment trying to sell industrial concerns better lighting.

While every new industrial lighting job cannot mean specific orders for every manufacturer of allied material, any one can see that an expenditure of, say, one million dollars for lamp and lighting equipment for industrial plants, bringing with it six million dollars of business for manufacturers of associated material, simply means that few manufacturers of such lines can afford to withhold support and active co-operation in the movement for better lighting.

CO-OPERATION MEANS MORE BUSINESS

More manufacturers of electrical equipment and products should believe and act according to the economic principle that the way for an individual manufacturer to benefit his own business—to make it grow increasingly—is to get out and help create more business within his group. No method of creating more electrical business has been found more effective than the policy of every one boosting the cause of greater utilization of electric service. Marked stimulation of business in one branch of the industry must eventually result in a degree of stimulation in all branches of the industry. A united front in the support of an activity that benefits one branch of the industry must eventually mean more business for all.

More Effective Electrical Inspection

Neither Utilities nor Manufacturers Should Urge Special Rules for Inspection—Opportunity to Help the Inspector—Responsibilities of Utilities Regarding Fuses

BY WILLIAM S. BOYD

Secretary Western Association of Electrical Inspectors, Chicago

UTILITIES and electrical manufacturers are aggressively pursuing a policy of a bigger and better job in the extension of electric service and the use of electrical equipment. If the gains made by this policy are to be held and consolidated, there must accompany this expansion of electric service and installation a bigger and better job of electrical inspection. Standards of living are constantly rising, and standards of good electric service are likewise on the up grade. The rapid expansion in the utilization of electric service places increasing burdens upon electric wiring and makes imperative a higher standard of quality, safety and satisfactory performance.

The utilities should be disgusted with the futile efforts it has made to get Rolls-Royce wiring service out of a Ford job of wiring and should bend its efforts to the raising of the wiring standard. Adequate electric inspection is a prerequisite to these important accomplishments. I believe it is fair to say that the electrical inspector has always been interested in maintaining standards of workmanship above the minimum prescribed by laws and codes. In other words, the electrical inspectors have sought to establish standards of workmanship not merely within the law but comparable to the American standard of living. Insistence upon a high standard of electrical inspection has contributed much to the prosperity of the electrical industry. There are some conditions existing today that limit to a degree the effectiveness of electrical inspection in maintaining this high standard of excellence. Some of these conditions can be influenced by the attitude of electrical manufacturers and utilities.

SPECIAL RULES THWART PROGRESS

Special rules frequently savor of class legislation and are always real obstacles to progress. The real danger from special rules is not so much that the rules are of themselves improper or unwise, but because the adoption of special rules weakens the adherence to any general code that has received universal approval. Special rules applied to conditions in particular localities or to particular devices or material always weaken the enforcement of the code itself with respect to the country as a whole or with respect to an approved list of devices and material. Utilities and manufacturers can do much to strengthen the general acceptance of the code by refraining from approval of special rules in their territory or with respect to their products.

The electrical inspector should be encouraged rather than discouraged in rigidly enforcing the standard rules as represented by the code because it has been demonstrated time and again that the moment the bars are lowered slightly the standards of workmanship and performance immediately go down. The unscrupulous contractor is encouraged and the politician gets an opportunity to mix in matters of whose real nature he is hopelessly ignorant. The inspector who adheres most rigidly to his instructions and his code is always in quiet water, but the inspector who is influenced to waive a point here and a point there is soon and forever after in trouble. If a particular practice is wrong, the attitude should be not to make a special rule but to change the code.

Responsibility for Safe Use

There is much discussion and some difference of opinion as to the best practice with regard to service fuses, whether they should be sealed or unsealed and the type of switch to use. There is probably much to be done in the development of service switch and fuse equipment. However, the greatest factor in the safe handling of fuses is the education of the customer in how to operate fuses safely. Some power companies report that they have found less evidence of tampering with fuses that have been unsealed than with fuses that have been sealed. It would appear, however, that central-station companies approving accessible fuses are in duty bound to instruct the public in safe and proper methods of handling the fuses and to see that instructions are followed. It is hard to believe that any device can be made foolproof, but it is not difficult to believe that the majority of the public are reasonably intelligent and can understand information given to guide them in the safe handling of service fuses. Many companies have done much in this direction and other companies are taking up the work with enthusiasm, with the result that in the districts served by these companies the abuse of fuses is bei g reduced to a negligible degree.

The hazards incident to the use of imperfect and unapproved appliances and devices are generally apparent to customers when their attention is called to it. The growing multiplicity of devices used and the tendency to reduce their price and to accept foreign-made products is a situation calling for the attention of utility executives to protect the lives and property of their customers and the good name of electric service. Thousands of unapproved and unsafe electrical products are being purchased daily, particularly Christmas tree lights at this time of the year, and sometimes from utility stores. Every utility and every other company selling electrical appliances and fittings should check its stock frequently against the list of approved appliances. In cases of doubt, an electrical inspector should be called in. Statements of salesmen and appearance of goods are sometimes deceiving. All the good work done by high standards of inspection on interior wiring may be nullified by unsafe appliances used at the end of the wire

It should be just as possible to convince the public of the importance of safe and approved devices for utilization of electrical energy as it is to convince it of the safe and approved installation of wiring itself. The electrical industry believes in high standards of material and workmanship because they promote safety and satisfaction in the use of electric service. The public can be educated in safe practices for handling electric utilization and protective devices, and as the public becomes more familiar with these factors in electric service it will become more enthusiastic in the use of this service.

The rapid development of the electrical industry has made it virtually impossible for the average inspector to maintain close personal contact with latest practices and to know enough of the engineering involved to pass competently on many installations and applications of electric service. The manufacturer in developing products and the utility engineers in looking ahead for new uses for electric service have worked out many of the problems of new applications so far as they are affected by the code, while the average electrical inspector is so busy with detailed inspections of the "common or garden variety" that he is often compelled on short notice to pass upon an application of whose fundamental nature and importance he is only slightly aware.

Here is an opportunity for the manufacturer and the central station to cooperate in educating and training inspectors. Most electrical inspectors would welcome the opportunity to become more familiar with the engineering features of their business and particularly with the new and growing applications of electrical devices connected to interior wiring systems.

Appliance Advertising

Manufacturers and Central-Station Companies Are to Co-operate in Concurrent Campaign

CONCERTED and concurrent appliance advertising of central-station companies and manufacturers during 1926, taking into account the seasonal demand, will become a reality with the support of the Commercial Section of the N. E. L. A., which was pledged by Chairman E. W. Lloyd at the last meeting of the section. In a communication to Mr. Lloyd the heating appliance section of the Associated Manufacturers of Electrical Supplies reported the unanimous and enthusiastic decision of that body to co-operate with the committee appointed by Mr. Lloyd, with particular reference to the concurrent advertising of toasters for March and percolators for April.

Chairman Lloyd looks upon this as a great opportunity for every central-station company to give a great impetus to the sales of these two load-building appliances. He hopes that every company will devote much advertising and sales effort to these appliances during the months designated.

Fourth Annual Power Show

Prominent Display of Combustion Control Apparatus—Recent Developments in Pulverized-Fuel Equipment—New Exhibit of Water-Cooled Furnace Walls

COMBUSTION apparatus probably received the greatest amount of attention at the fourth annual Exposition of Power and Mechanical Engineering, which was held this week at the Grand Central Palace, New York. There were 394 manufacturers who exhibited their products this year, whereas last year there were only 370 exhibitors and the previous year only 260. As usual the exposition covered many new developments in the power-plant equipment field and reflected the increasing tendency to make apparatus safer to operate.

Particular interest was shown in new types of combustion-control equipment and boiler-room instruments, one company showing a feeder and meter for pulverized coal which is intended to masure coal taken from the storage bins and deliver it to the burners. There were many exhibits of stokers and pulverized-fuel equipment, three exhibits being of comparatively recent development. Many large-sized commercial units were on display. One company showed a 5,000-lb.-per-hour unit mill, another exhibited a 12,000-lb.-per-hour unit pulverizer embodying as improvements a motor-driven feeder and a magnetic separator for the removal of tramp iron. In another case a unit pulverizer was shown which had a primary pulverizing chamber and a secondary chamber. A complete pulverized-coal installation was exhibited in which a small conical ball mill was in operation grinding river coal. The pulverized product was removed from the mill through a rotary classifier, also a recent development, by air separation and discharged to a fuel bin. A stoker equipped with a power drive was also seen in operation.

Increased interest is seen in new displays of water-cooled furnace walls and air preheaters. In one type of water-cooled furnace wall shown the water tubes were arranged inside the furnace with the insulation outside. In another type the water tubes are outside of the furnace bricks. A new type of economizer was shown in which the tubes have extended surfaces and are lead-coated to resist the external corrosion caused by sulphuric acid in the flue gases and the internal corrosion due to oxygen in the water. A soot blower was also shown in which the main-line steam valve and the blower elements are electrically operated.

Exhibits of reduction gears and improved types of couplings indicate the increasing interest in such equipment. Both horizontal and vertical drive reduction gears were on display, some being of fairly large capacity. Among

the large commercial units shown was a 700-hp. steam turbine for operation at 550 lb. pressure with a steam temperature of 750 deg. F. and at 80 lb. back pressure. Several types of oil-burning equipment were also shown.

A new form of short center drive using a V-type belt was seen driving an exhaust fan. A crankless Diesel engine was also exhibited for the first time. The machine shown had a capacity of 150 hp. It was of the two-cycle type with four cylinders 7½ in. diameter, 9 in. stroke. Power is transmitted to a wabble or driving plate fixed on the main shaft at an angle of approximately 22½ deg., thus translating the reciprocating motion of the piston to a rotary motion.

Census of Manufactures

The Bureau of the Census is making plans for the next biennial Census of Manufactures, which will cover the year 1925, as provided in the act of Congress approved March 3, 1919. In deciding upon the items to be covered by the census, the bureau has consulted with the representatives of various manufacturers' associations with a view to securing, as far as practicable and without making the schedule too elaborate, information which will be of value to the representatives of the several industries concerned and at the same time furnish a record of the progress of manufactures generally throughout the United States. The blank forms upon which reports should be made will be mailed by the bureau to all manufacturers about January 1, and a report will be required from each manufacturer whose gross products are valued at $5,000 or more for the year 1925.

October Delinquent Accounts Increase Over September

WHILE the delinquent electrical acounts for October show an increase in the number, for the Central, New York and Middle and Southern Atlantic States divisions, as compared with the same month last year, the total amount and average amount show a decrease for all sections except the Central and New York divisions. As compared with the preceding month of September, the trend is upward, with the increase in the average amount not very great except for the New England division, where the increase is about 20 per cent.

DELINQUENT ACCOUNTS IN OCTOBER

Branch and Month	Number of Accounts Reported	Total Amount	Average Amount
Central Division:			
September, 1924	971	$106,842.84	$110.03
September, 1925	822	102,325.97	124.48
October, 1924	882	95,059.06	107.78
October, 1925	927	117,235.23	126.46
New York:			
September, 1924	338	55,652.00	165.00
September, 1925	241	30,150.00	125.00
October, 1924	300	34,083.00	113.00
October, 1925	311	39,307.00	126.00
Middle and Southern Atlantic States:			
September, 1924	243	28,231.73	116.18
September, 1925	215	28,689.06	133.44
October, 1924	217	23,777.23	109.57
October, 1925	279	22,024.57	78.94
New England:			
September, 1924	62	6,385.51	102.88
September, 1925	104	4,560.73	43.85
October, 1924*	65	8,788.38	135.20
October, 1925	61	3,965.32	65.00
Pacific Coast:			
September, 1924	25	3,137.67	125.50
September, 1925	18	1,349.85	74.99
October, 1924	45	5,578.65	123.97
October, 1925	19	1,524.00	80.21

* Note correction on New England Division figures for October, 1924.

Business Conditions

HYDRO-ELECTRIC generating equipment has been in active demand in various sections of the country. Orders placed amount to more than $1,000,000 and include one for three units totaling 24,000 kw. from Maine, another for eight units amounting to 108,000 hp. from Kentucky and a third from San Francisco for a 40,000-hp. unit. Auxiliary apparatus was also purchased at the same time. The normal central-station demand is reported as continuing very good, and some interesting orders for switching equipment are reported. The purchase of ten passenger electric locomotives by the New York Central Railroad, amounting to about $1,200,000, was announced this week, and plans are rapidly maturing for the electrification of the New York Central west side freight line as well as other New York City freight terminals.

Industrial plants in virtually all sections of the country are buying steadily, the trend is upward, and it is known that many electrification plans are under way. There has been a good demand for street-lighting equipment, particularly from Florida, and reports from the entire country indicate a holiday season demand for electric appliances that is larger than ever.

In New England electric power equipment has been in active demand, one order placed calling for a total of more than 24,000 kw. in capacity. In addition, many inquiries are reported from widespread sources. General-purpose motors are selling well in that district, and plans under way for the motorization of a number of large plants indicate a continued demand for that equipment. The activity of all the large utility companies in the New York district is creating a demand for equipment, particularly transformers, outdoor substations and other auxiliary apparatus. Industrial-plant buying continues active, and orders for motors and control equipment and general supplies are reported to be in good volume. In the Southeast the demand is good, with the orders coming mainly from Florida and consisting of general supplies, construction materials and "white-way" equipment, one order for the latter amounting to $110,000. The volume of business is increasing in the Middle West, and the demand for distribution equipment has been brisk. Although the failure of certain agricultural products was felt to some extent in some farther Western states, manufacturers in those states report good business. On the Pacific Coast large orders for hydro-electric generating equipment amounting to over $250,000 were placed for the first of four units for the Balch plant on the Kings River.

Volume of Business Increasing in the Middle West

GOOD business continues throughout the Middle West, with the volume transacted gradually increasing. While the failure of certain agricultural products was felt to a certain extent in some farther Western states, industrial manufacturers even in these states report good business. Distribution equipment is still being bought by the various utility companies, and there has been a brisk demand for station-type meters, several sizable orders being placed this week. An interesting order for approximately 350,000 lb. of copper busbar was placed by one utility company. Among other interesting orders was one for seven electric vehicles and a quantity of high-tension fuses. Jobbers' sales are steadily increasing as the holiday season draws near. All appliances are moving well, particularly washing machines, one jobber placing an order this week for 500 units. Extensive campaigns on kitchen lighting have resulted in volume sales of that commodity.

Electrical Power Equipment Active in New England District

GENERATORS, motors and turbo-generator units are attracting most interest in New England at the present time. The Central Maine Power Company has placed an order for three 8,000-kw. generators to be used on the new Gulf Island hydro-electric development near Lewiston. A large manufacturer of turbo-generator units reports many inquiries from widespread sources. Small motors continue to sell well, and plans are reported on foot for the motorization of a number of large plants. It is reported that the New Haven railroad plans to expend $1,000,000 on a rehabilitation scheme for both its Worcester and Springfield shops.

The demand for construction supplies is spotty, though one prominent jobber records that the movement of pipe, wire and hardware is keeping up quite strong, and that the demand for socket units and wiring devices is brisk. The New England Telephone & Telegraph Company has authorized the expenditure of $281,456 for new construction work during the remainder of the current year, most of which will be applied to extensive underground cable and station layouts. Electrical specialties are the feature of the jobbing trade at the present time with radio equipment very strong and domestic household appliances gaining in strength as the season advances.

Large Equipment Orders Placed on the Pacific Coast

AN ORDER for more than $250,000 was placed by the San Joaquin Light & Power Company through its San Francisco office for the first four units for the Balch plant on the Kings River. One impulse-type waterwheel of 40,000 hp. and two waterwheel-

driven exciter units were ordered from one manufacturer, and a 33,000-kva. generator with transformers, switchboard and auxiliary equipment was ordered from another company. Power company purchasing other than the above has also been good and included a number of tools, five carloads of 40-ft. poles and four carloads of very large poles from 60 ft. to 70 ft.

Line-construction material is moving well all over the territory. The city of Seattle has purchased 60,000 lb. of weatherproof copper wire and approximately $10,000 worth of cross-arms. Inquiries have also been received covering 6,000 lb. of No. 8 bare copper wire and 4,000 lb. of No. 6 bare copper wire. Dealers' business is good, and from all reports appliance sales are heavy. Prices on steel lines such as flexible conduit and conduit boxes have advanced about 15 per cent in two recent steps, and indications are that rubber-covered wire will soon advance in price.

"White-Way" Equipment in Demand in the Southeast

GOOD orders for electrical supplies, construction materials and "white-way" equipment, mainly coming from Florida, are reported in the Southeast. One order was recently received for $110,000 worth of "white-way" equipment for one development in that state. Satisfactory orders and a promising number of inquiries are being received from industrial plants for improved lighting equipment, though the volume is not quite up to anticipations. Contractors are placing orders better than normal for all wiring supplies, and the volume of orders for appliances is particularly good.

A satisfactory volume of orders for small motors from 5 hp. to 25 hp. is reported, with quite a bit of activity in printing-press equipment for Florida. Inquiries for steam turbines of capacities under 10,000 kw. are much better than usual, and prospects are for the purchase of a number of units by industrial plants and small central-station companies in the very near future. Orders for distribution transformers and distribution-type watt-hour meters are keeping pace with the demand for construction materials.

Central Stations Buying Actively in New York District

LARGE central-station and holding companies in the New York district have been active in purchasing transformers, switching equipment and auxiliary apparatus. A large outdoor-substation order is reported, inquiries for that class of material are good, and a quotation to a Canadian industrial plant covers about $18,000 worth of such equipment. One or two of the smaller utility companies have been active in making extensions and improvements, but in general the larger companies have been comparatively more active. Some good orders for auxiliary apparatus which it was expected would be placed in this district are still in abeyance.

Purchases of general-purpose motors continue to be good and are very much better than sales of generating equipment to industrial plants. The market is active and has brought about a better attitude among motor manufacturers—an attitude that was lacking earlier in the year. Sales of electrical supplies during the last quarter of this year are better than for the same period last year, and electric appliances are in greater demand than ever before.

Non-Ferrous Metal Market Quiet—Prices Decline

THOUGH consumption of the metals continues as great as ever and there seems no prospect of an early slump in manufacturing operations, buying of the metals generally has been in only limited volume and prices have declined further owing to the weak London market, which has reacted to cause American buyers to withhold orders. Consumers were offered copper as low as 14¼ cents delivered—a price that could be obtained in more than one direction. The total volume of business is much less than that reported last week, even allowing for the Thanksgiving holiday, when all markets were, of course, closed.

NEW YORK METAL MARKET PRICES

	Nov 25, 1925 Cents per Pound	Dec. 2, 1925 Cents per Pound
Copper, electrolytic	14¼	14¼
Lead, Am. S. & R. price	9¼	9¼
Antimony	20	20
Nickel, ingot	34	34
Zinc, spot	9	8.725
Tin, Straits	62¼	63½
Aluminum, 99 per cent	29	29

Base copper price Dec. 2, 1925, 16½ cents

The American Smelting & Refining Company on November 30 cut its official contract price for New York lead from 9¾ cents to 9¼ cents, this being the first reduction since June 30, when the price was fixed at 8 cents per pound. Since then the trend has been steadily upward.

Activities of the Trade

Allis-Chalmers Receives Large Hydro-Electric Equipment Order

An order for more than $500,000 has recently been placed with the Allis-Chalmers Manufacturing Company, Milwaukee, by the Louisville Hydro-Electric Company for eight water-wheels and generators, having a capacity of 13,500 hp. each, besides auxiliary equipment. This equipment will be used at the station at Dam No. 41 on the Ohio River, near Louisville, which is now being constructed for the Louisville company. The above apparatus will constitute the initial capacity of 108,000 hp. The ultimate capacity of the station will be 135,000 hp. It is estimated that orders received by the Allis-Chalmers company during November will show the largest aggregate for several months.

Industrial Truck Manufacturers Co-operative Program for 1926

At a meeting held in Cleveland on November 10 the industrial truck and tractor manufacturers reviewed the progress made during the past year in their co-operative market development program under the direction of the Society for Electrical Development. At the meeting it was considered desirable to adopt an industry program along the lines of "Move it electrically for less," a slogan which all the manufacturers will use in their advertising copy. Efforts will be made also to have this same procedure carried out by additional groups of electric material-handling machinery manufacturers, in co-operation with whom plans for similar promotional programs are now being worked out.

Included in the group of manufacturers co-operating through the society in furthering a program of business building during the coming year are the following: Automatic Transportation Company, Baker R & L Company, Crescent Truck Company, Elevator Electric Industrial Truck Company, Elwell-Parker Electric Company, Lakewood Engineering Company, Yale & Towne Manufacturing Company, Edison Storage Battery Company, Electric Storage Battery Company, Philadelphia Storage Battery Company, Electric Products Company, Sangamo Electric Company, General Electric Company and the Westinghouse Electric & Manufacturing Company. It is anticipated that additional companies will be added to the group before January 1, 1926.

International General Electric Orders Show Increase

It is estimated that orders placed with the International General Electric Company this year will amount to more than $25,000,000. This will be an increase of about 50 per cent as compared with bookings last year, which amounted to $17,800,000. During this year the company has been able to maintain very good deliveries, and it is reported that the volume of orders is continuing very satisfactory. Billings in 1924 were $22,590,108, and this year they are expected to show practically the same total. If the current rate of business is maintained—and there are indications that it will be—billings next year will show a decided gain.

The Lindsley Brothers Company, 5 South Wabash Avenue, Chicago, producer of Western red-cedar poles, has just completed the celebration of the thirtieth anniversary of its incorporation. The company started in business in Menominee, Mich., in 1895, under the leadership of Edward Ashburton Lindsley, and it now operates in both Canada and the United States, maintaining offices in New York, Kansas City, Chicago, Minneapolis, Spokane, Montreal

and Nelson, B. C., with concentrating yards and butt-treating plants in both the Eastern and Western cities.

The Superheater Company, 17 East Forty-second Street, New York, announces the appointment of R. L. Ehmann as district manager of its industrial department with an office at 923 Union Trust Building, Pittsburgh. The former manager of the Pittsburgh office, John R. LeVally, has been assigned to special duties and can be reached through the New York office.

The Combustion Engineering Corporation, 43 Broad Street, New York, has recently purchased the George T. Ladd Company, First National Bank Building, Pittsburgh, Pa., manufacturer of the Ladd water tube boiler.

The Wagner Electric Corporation, St. Louis, announces that on January 1 its Seattle office will be removed from 538 First Avenue South to 1919 First Avenue South. M. E. Cundall is district manager.

The C. H. Wheeler Manufacturing Company, Lehigh and Sedgley Avenues, Philadelphia, has received an order for the condenser units for the new municipal power plant in Detroit, amounting to about $144,000. This corrects an item appearing on page 1078 of the November 21 issue of the ELECTRICAL WORLD.

The American Brown, Boveri Electric Corporation has established temporary offices at 165 Broadway, New York, and after May 1 will occupy permanent quarters on the twenty-third floor at the same address.

The Bridgeport Brass Company, Bridgeport, Conn., in commemoration of its sixtieth anniversary has had reprinted and is distributing in pamphlet form a historical account of the company from its beginning in 1865 up to the present day.

The Electric Storage Battery Company, Philadelphia, will soon proceed with the erection of its proposed two-story local branch plant at 200 West Third Street, San Francisco, estimated to cost $125,000, with equipment.

Charles Engelhard, Inc., 30 Church Street, New York City, announces the development of a mercury-contact switch for use in connection with the company's pyrometer recorder.

The General Electric Company, has awarded a general contract for the erection of a one-story addition, 60 ft. x 100 ft., at its Lynn (Mass.) works.

The Hub Electric Company, 2219 West Grand Avenue, Chicago, announces that it has recently shipped the largest stage control board ever built to Los Angeles for use in the newly constructed Al Malaikah Temple. The company says this board is of the "Locke" system type and was designed especially for this building.

The Brown Brockmeyer Company, Inc., Dayton, Ohio, which was incorporated on June 20, 1925, and which went into production on August 15, is at the present time manufacturing motors in the ½-hp. and ¾-hp. sizes only, but it now states that other motors in smaller as well as larger sizes are now under development and will soon be ready for the market. E. W. Brockmeyer, secretary and vice-president of the company, for the past five years has been chief engineer for the Master Electric Company of Dayton. Steffen A. Brown, president and treasurer of the company, has been associated for the past three years with the Leland Electric Company of Dayton as vice-president and sales manager.

The General Electric Company announces that it is now placing on the market its type B-2 "thermotel," a load indicator for 60-cycle, 2,300-volt subway-type distribution transformers from 15 kva. to 200 kva. inclusive. This instrument is similar to the "thermotel" for pole-type transformers, which was described in the March 7 issue of the ELECTRICAL WORLD.

The Delta-Star Electric Company, 2400 Block Fulton Street, Chicago, has been awarded the contract for the 132,000-volt super-power unit-type outdoor substations to be installed at Athenia, N. J., and Trenton, N. J., by the Public Service Gas & Electric Company of Newark.

The Nordberg Manufacturing Company, Milwaukee, has announced the receipt of a contract from the Hollywood Land & Water Company, Hollywood, Fla., amounting to approximately $350,000 for the building and installation of two 2,250-hp. Diesel engines to be used for generating electricity. The Nordberg company has recently completed the installation of a 1,250-hp. Diesel engine at Hollywood.

New Equipment Available

Limit Switch

A machine limit switch of compact design has been developed by the Monitor Controller Company, Baltimore, Md., the over-all maximum dimensions of the switch being 4 in. x 2¼ in. x 2¼ in. This switch is designed to handle pilot circuits of direct-current or alternating-current starters and controllers and can be used as a limit switch to provide overtravel provision, as an interlock switch on machines or for other purposes of like nature.

This switch, which is absolutely dust-tight, is made in two types, one having contacts normally open and the other having contacts normally closed. The standard type of construction has copper-to-copper contacts of large size which operate under heavy contact pressure. For special applications, the switches can be provided with silver contacts.

Transfer "Disconnect"

A transfer disconnecting switch used in connection with precipitation systems and designed to mount on the top frame of a bus structure has been placed on the market by the Delta-Star Electric Company, 2400 Block Fulton Street, Chicago. The hinge contact of the switch blade is connected to the precipitator, one jaw contact is connected to the rectifier. The "disconnect" thus makes it possible to keep the precipitator in continuous operation, even though its individual rectifier may be out of service.

Position Indicator for Inclosed Circuit Breakers

A device which automatically indicates the position of the main circuit contacts of a totally inclosed water-tight circuit breaker, without the cover being removed or the casing in any way disturbed, has been devised and is used by the Westinghouse Electric & Manufacturing Company on its new F-11 subway oil circuit breaker. The device consists primarily of a plug, similar to the ordinary plug used on seal breakers, which screws into the case. Slots on the inside of the plug correspond with the open or closed position of a pin fastened to the breaker mechanism arm, and the plug can be inserted only when correct co-ordination of the slots and pin is made. The outside of the plug has molded in its surface the words "open" and "closed," either of which is at the top when the breaker is in the corresponding position.

Disconnecting Switch

A three-pole group-operated indoor disconnecting switch of phase-separation design, having a hand-operated mechanical remote-control device, has been placed on the market by the Electric Power Equipment Corporation, 412 North Eighteenth Street, Philadelphia. The switches are of the heavy-duty type. They are fitted with a vertical operating shaft of cold-rolled steel having an insulated section of impregnated wood between phases. The operating wheel or control mechanism connects with the vertical operating shaft by means of a pair of beveled gears.

The switch is fitted with an interlocking device which will effectively lock the operating shaft of the disconnecting switches in either the open or the closed position in conjunction with an oil switch. A cell-door lock is so arranged that the door is locked when the disconnecting switches are closed and unlocked when the switches are open.

Hoist Controller.—A reversing controller with rope-operated control master station of the self-centering type, intended for use on traveling cranes, chain and rope hoists, etc., has been placed on the market by the Monitor Controller Company, Baltimore. The equipment is of standardized design and intended for direct-current and polyphase alternating-current motors that are thrown across the line for starting. The controller, of the inclosed type, essentially consists of two double-pole mechanically interlocked contactors having graphite-to-copper contacts, blowout magnets and suitable barriers. The dimensions of the controller are 8½ in. x 10½ in. x 6 in.

New Trade Literature

MEASURING INSTRUMENTS.—Bulletin No. 1,105 issued by James G. Biddle, 1211-13 Arch Street, Philadelphia, describes the "Jagabi" speed-measuring instruments, including type C hand tachometer for indications of speed, hand tachoscope for speed measurements, speed indicator and hand tachograph. Attention is also called to the "Frahm" vibrating-reed tachometer.

FLOW METERS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-133, covering the various types of the "G-E" electrically operated flow meters for measuring steam, water, oil, gas, etc.

CREOSOTING MATERIAL.—"Enemies of Your Pole Lines and How to Defeat Them" is the title of a booklet issued by the Texas Creosoting Company, Orange, Tex., in which it calls attention to the chief causes of defects in wooden poles and tells how to prevent loss against decay and fire. Attention is also called to the Texas "Black Beauty" poles, manufactured by the company, which have been treated with creosote oil.

PAINTS.—The Goheen Corporation of New Jersey, Newark, N. J., has issued bulletin No. 103, containing specifications for its damp-proofing and waterproofing paints, which has been designed to aid those in charge of construction and maintenance work in the selection, specifying and use of paints. It contains instructions for the preservation of iron and steel and gives direction for general painting. Samples of its various types of paints are also included in the bulletin.

TURBINE-OIL PURIFICATION.—"The Super-Centrifugal Treatment of Turbine Oils" is the title of a bulletin issued by the Sharples Specialty Company, Twenty-third and Westmoreland Streets, Philadelphia. The bulletin discusses the problem of turbine lubrication and describes the distinctive features of the Sharples process for the treatment of turbine oil. A comparison is made of the Sharples process and other methods, and the deterioration of turbine oil is treated in the bulletin. Other power-plant uses for the "Super-Centrifuge" are also described.

MEASURING INSTRUMENTS.—Taylor Instrument Companies, Rochester, N. Y., has issued catalog part 4,000, covering its "Tycose" and thermo-electric pyrometers and "Tycos" thermocouples for measurement and control of high temperature in manufacturing processes. Illustrations are given showing various applications of the instruments and also instructions for selecting and installing "Tycos" thermocouples and information for wires and cables to use with "Tycos" pyrometers. Tables showing temperature millivolt equivalents are included.

SPLICES AND TAPES.—"Splices and Tapes for Rubber-Insulated Wires" is the title of a booklet issued by the Okonite Company, Passaic, N. J., in which it calls attention to the importance of a perfect splice, the important properties of tape, how to recognize these properties and how to make a perfect splice. Attention is also called to other Okonite products, including "Manson" tape, Dundee "A" and Dundee "B" tapes and Okonite rubber cement.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Calgary, Alberta, Canada (No. 17,974), of battery jars and covers.

Purchase is desired in Nottingham, England (No. 17,973), of electrical household appliances; also for radio parts (No. 18,015).

An agency is desired in Lyons, France (No. 18,008), for insulators and insulating materials.

An agency is desired in Genoa, Italy (No. 18,041), for electric meat-slicing machines.

Sole agency is desired in London, England (No. 18,006), for white, low-tension porcelain insulators.

Purchase is desired in Derby, England (No. 17,972), of radio sets and parts.

An agency is desired in Sydney, Australia (No. 17,946), for electric waffle irons for hotels, cafés, etc.

An agency is desired in Berlin, Germany (No. 17,945), for measuring instruments.

TRANSFORMERS AND SPARES FOR SYDNEY, AUSTRALIA. — Specifications have been issued by the State Electricity Commission of Victoria, Melbourne, Australia, according to *Commerce Reports*, asking for bids (until Dec. 29) on seven 1,000-kva., 50-cycle, 22,000/6,600-volt outdoor-type transformers and spares. Copies of specifications are on sale at the New York and Chicago district offices of the Bureau of Foreign and Domestic Commerce.

EQUIPMENT FOR BUNNERONG POWER HOUSE, SYDNEY, AUSTRALIA.—Tenders will be received by the Town Clerk, Town Hall, Sydney, New South Wales, Australia, for equipment for the Bunnerong power house as follows: (1) For six 25,000-kw. turbo-alternators, specification No. 954, until Feb. 1, 1926; (2) for eighteen 100,000-lb.-per-hour boilers, etc., specification No. 964, until Feb. 8, 1926; (3) for power-house switchgear, 33,000 volts, specification No. 974, until Feb. 22, 1926. Specifications may be obtained from Preece, Cardew & Rider, 8 Queen Anne's Gate, Westminster, S.W.1., on payment of 10s. 6d. per copy.

DIESEL ENGINE, ALTERNATOR AND SWITCHBOARD FOR GISBORNE, NEW ZEALAND.—Tenders are being asked by the Borough Council, Gisborne, New Zealand (no date), for furnishing Diesel engine, alternators and auxiliary plant, rotary converter and switchboard. Specifications and further information may be obtained at the office of William Coward & Company, Ltd., 22 Buckingham Gate, London, S.W.1. W. H. Buswell is borough electrical engineer.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SPRINGFIELD, MASS.—The New York, New Haven & Hartford Railroad Company, New Haven, Conn., contemplates improvements in its traction lines at Springfield, Worcester and Pittsfield, Mass., and will require electrical equipment, etc.

WORCESTER, MASS.—Plans are under consideration by the New England Power Company to erect a transmission line from its Surge Hill power station, near Reedsboro, Vt., to Bennington, Vt.

BRISTOL, CONN.—The City Council is considering extensions in the street lighting system in various parts of the city, including the installation of ornamental lamps on Main Street, from the Memorial Boulevard to North Main Street, and on other streets in the downtown section.

HARTFORD, CONN.—The Street Department plans to install thirty additional ornamental standards in the business section.

Middle Atlantic States

BALLSTON SPA, N. Y. — Plans are under consideration by local residents to expend about $50,000 to establish a fire department and to install a new fire-alarm system.

BROOKLYN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Dec. 23, for electric generator for power house for the Brooklyn State Hospital.

CENTERVILLE, N. Y.—Permission has been granted to the Niagara, Lockport & Ontario Power Company, Buffalo, to extend its electric distribution system to serve the towns of Centerville and Arcade, and to exercise franchises granted by the Town Boards.

CORNING, N. Y.—The Corning Milk & Cream Company, Inc., plans to build a power plant in connection with its milk and cream plant, now under construction.

ELMIRA HEIGHTS, N. Y.—The International Rayon Corporation, 171 Madison Avenue, New York, contemplates the construction of a power plant at its proposed local artificial silk mill. The cost of the project is estimated at $1,250,000. Andrew J. Sauer & Company, 1505 Race Street, Philadelphia, are architects.

JORDAN, N. Y.—The Jordan Electric Light & Power Company has applied for permission to exercise electric franchises granted by the towns of Elbridge, Camillus and Lee. The company plans two extensions, one from Elbridge and one from Jordan. The service in Van Buren will be to supply the newly organized district of Memphis. Electricity will be secured from the line of the Niagara, Lockport & Ontario Power Company, near Memphis.

NEW YORK, N. Y.—Electric power equipment will be installed in the proposed printing plant to be erected at South and Water Streets by the "Evening Journal," 2 Columbus Circle. The cost is estimated at $2,500,000.

NEW YORK, N. Y.—The plans for the electrification of the west side freight line of the New York Central Railroad Company, which have been approved by the Public Service Commission, include two substations under the slopes of Riverside Drive, one to be located at Seventy-second Street and the other at 158th Street. The cost is estimated at $30,000,000.

NORWICH, N. Y.—The New York State Gas & Electric Company, Ithaca, is planning to erect a 44,000-volt transmission line from Norwich to Hamilton.

NORWICH, N. Y.—A committee has been appointed by the Council to make investigations relative to the installation of an ornamental lighting system.

POUGHKEEPSIE, N. Y.—Permission has been granted the Central Hudson Gas & Electric Company to extend its lines to serve the towns of Ancram and Gallatin. The company plans to erect a line about 16,000 ft. in length through the towns of Ancram and Gallatin to serve the hamlet of Gallatinville.

WILLARD, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Dec. 23, for a telephone system for the Willard State Hospital.

BARRINGTON, N. J.—The Borough Council has authorized improvements and extensions in the street-lighting system. It is proposed to use 400 cp. arc lamps at all street intersections.

CEDAR GROVE, N. J.—Bids will be received by the Township Committee until Dec. 7 for lighting the streets of the township during 1926.

HAWTHORNE, N. J.—Bids submitted for the installation of a fire-alarm system have been rejected by the Borough Commissioners. New bids will soon be asked for.

MATAWAN, N. J.—The Jersey Central Power & Light Company, Allenhurst, plans improvements in its local system. The Borough Council is negotiating with the company to replace the present wood poles with iron posts.

NEWARK, N. J.—Bids will be received by the Board of Education, City Hall, until Dec. 9 for electrical supplies for city schools, also at the same time, for electrical work in the Robert Treat school to be erected on Thirteenth Avenue. R. D. Argue is secretary.

THREE BRIDGES, N. J.—The New Jersey Power & Light Company, Dover, which recently acquired the local electric plant, will soon begin work on the erection of a transmission line from Flemington to Three Bridges, a distance of about 4 miles. The company, it is said, also plans to erect a line from Holland to Lambertville.

CENTERVILLE, PA. — The Village Board has awarded a contract to the Titusville (Pa.) Light & Power Company for the installation of a new street-lighting system throughout the village.

COATESVILLE, PA.—Plans are under way by the Chester Valley Electric Company for the erection of a transmission line over Black Horse Hill which will serve a large territory in West Brandywine Township between here and Brandywine Manor.

ERIE, PA.—Plans for the proposed grain elevator to be erected by the West Side Feed Company in the Highland Park section include a power plant.

FLEETWOOD, PA.—The Fisher Body Corporation, General Motors Building, Detroit, plans to install electric power equipment in the proposed addition to its local branch plant, to cost about $250,000.

LANDSDALE, PA.—The installation of a new generating unit at the municipal electric plant is under consideration.

PHILADELPHIA, PA.—The Department of Transit, 1211 Chestnut Street, plans to install electric power equipment in the proposed terminal shops, repair plant and yards near Broad Street and Olney Avenue, for the Broad Street subway system, to cost about $1,500,000.

YOUNGVILLE, PA. — Plans are under way by the Village Trustees for extensions to the street-lighting system throughout the Village, to cost about $15,000.

WILMINGTON, DEL. — The proposed plant to be erected at Deepwater Point by the Eastern Alcohol Corporation, a subsidiary of E. I. du Pont de Nemours & Company, Wilmington, to cost about $500,000, will be equipped with electrically-operated machinery.

BROOKNEAL, VA.—The construction of proposed hydro-electric power plants at Brookneal and at Hyco Falls on the Dan River, at a cost of about $750,000, and the completion of a high-tension line to connect the power plants at Chase City, Clover, Victoria, Crewe, Blackstone, Burkeville, La Crosse, Broadnax and Lawrenceville, to cost about $1,250,000, has been announced by William C. Whitner & Company, Richmond, engineers and general managers of the Southside Power Company. Ira and Charles T. Vaughn, Philadelphia, are interested in the company.

WINCHESTER, VA.—The A. G. Jones Mills Corporation plans to install a steam-driven power plant in connection with extensions to its local textile mill.

WASHINGTON, D. C.—Bids will be received at the office of the General Purchasing Officer, the Panama Canal, Washington, D. C., until Dec. 12 for wire rope, cable, wire, bushings, terminals, solder, brass and copper tubing, etc., as per circular No. 1,711.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Dec. 15 for twelve motor-generators and spare parts for various yards (Schedule 4729); also, for 22,900 dry batteries, 75,800 flashlight batteries, etc., for various yards (Schedule 4723).

WASHINGTON, D. C.—Bids will be received by the United States Veterans' Bureau, Room 791 Arlington Building, Washington, D. C., until Dec. 22 for construction complete of one administration building and one clinic building at the United States Veterans' Hospital No. 32, Mount Alto, Washington, including heating and electrical work, electric elevator, mortuary refrigerator and outside connections, etc. Separate bids will be received for the electric elevator.

North Central States

DETROIT, MICH.—Plans of the Michigan Bell Telephone Company provide for an expenditure of about $23,000,000 for extensions in Michigan during 1926. Total additions to exchange line will cost about $7,100,000, and extensions to toll and long distance system, $2,400,000. The expansion program calls for the installation of two billion conductor feet of wire in cable alone, about half of which will be installed in the Detroit exchange. A third automatic exchange will be installed in Detroit. Outside of Detroit the program calls for the establishment of an automatic exchange in Kalamazoo, while new manual central office equipment is planned for thirteen other cities. The Detroit-Pontiac-Flint toll cable will be extended to Saginaw in 1926, and to Bay City in 1927. The toll cable between Detroit and Red Ford will be placed underground next year, and an additional cable from Detroit to Wyandotte is planned.

GRAND LEDGE, MICH.—The Consumers Power Company, Jackson, is said to be planning the construction of a transmission line in this section.

SAGINAW, MICH.—Extensions and improvements are contemplated by the Saginaw Products Company to its works, including an addition to the power house. The cost is estimated at $250,000.

BEREA, OHIO. — Extensions and improvements are contemplated to the municipal electric plant for which $65,000 in bonds have been approved.

CINCINNATI, OHIO.—The Worthington Pump & Machinery Corporation, Elmwood, Cincinnati, plans to install electric power equipment in its proposed plant addition, to cost about $130,000.

EAST CLEVELAND, OHIO.—The City Council plans to install a traffic and police signal system, for which $50,000 in bonds have been approved.

HAMILTON, OHIO.—The installation of an ornamental lighting system on Tiffen Avenue, to cost about $4,500, is under consideration by the City Council.

SPRINGFIELD, OHIO.—The Ohio Edison Company has applied for permission to acquire the property of the Indian Lake Light & Power Company, and plans extensions in transmission lines in this district.

BOWLING GREEN, KY.—Surveys are being made by the Kentucky-Tennessee Light & Power Company, for a transmission line from Brownsville to the Ohio River to connect its properties along the river with its transmission system. The line from Bowling Green to Brownsville is to be changed to 66,000 volts and the new line from Brownsville to the Ohio River will also operate at 66,000 volts. H. D. Fitch is president.

CENTRAL CITY, KY.—The Kentucky Utilities Company, Louisville, is planning extensions in its transmission lines in this section. A local franchise has been granted.

NEW CASTLE, IND.—Plans are being prepared by the City Council for the installation of an ornamental lighting system in the business district and extending into part of the residence section. The plans call for more than 200 pedestals.

CHICAGO, ILL.—Bids will be received by the Signal Corps Procurement District, United States Army, until Dec. 15, for telephone equipment, including transmitters, desk instruments, rectifier bulbs, radio condensers, etc. (Circular 11). Also, until Dec. 29, for 6,000 switchboard plugs (Circular 10).

PEORIA, ILL. — The installation of a synchronized electric traffic signal system, consisting of 136 signals, to cost about $35,000, is under consideration. W. E. Backus is city engineer.

PEORIA, ILL.—The Woodruff Ice Company plans to build a cold storage and refrigerating plant, to cost about $125,000. Hewitt & Emerson, Peoria Life Building, are architects.

APPLETON, WIS.—The Wisconsin Traction Light, Heat & Power Company contemplates extending its transmission line to supply electricity in the towns of Royalton, Northport and Lebanon.

ASHLAND, WIS.—Plans have been announced by the Lake Superior District Power Company for the erection of a 33,000-volt transmission line, 63 miles long, to connect its system in Medford with its Big Falls hydro-electric plant, near Ladysmith. The cost of this line, which will serve Glen Flora, Hawkins, Catawba, Kennan, Pennington, Ingram, Prentice, Ogema, Westboro, Chelsea, Whittlesey, Medford, and numerous smaller communities, is estimated at $115,000.

CASSVILLE, WIS.—At a special election held recently the proposal to appropriate $12,000 for extensions and improvements to the municipal electric plant and distribution system was approved by the voters.

GREEN BAY, WIS.—Work will begin at once by the Wisconsin Public Service Corporation on the construction of a steam-driven electric generating plant at the junction of Green Bay and Fox River. The plant will have an initial capacity of 26,800 hp., and will be built by the Bylesby Engineering & Management Corporation, 208 South La Salle Street, Chicago.

HAWKINS, WIS.—The electric properties of the Hawkins Electric Light & Power Company have been acquired by the Lake Superior District Power Company, Ashland, which plans to furnish local service from the proposed high-tension line to be erected between its Big Falls power plant and Medford.

MADISON, WIS.—A petition has been presented to the City Council asking for the installation of ornamental lamps on East Washington Avenue from Capital Square to Milwaukee Street.

MADISON, WIS. — The installation of additional lamps on the south side as well as in various other parts of the city has been recommended to the City Council by the street lighting committee.

MILWAUKEE, WIS.—The Teutonia Avenue Advancement Association has submitted a petition to the City Council requesting the installation of an ornamental lighting system on that thoroughfare.

COLD SPRING, MINN. — The Cold Spring Granite Company contemplates the rebuilding of its power plant and machine shop recently destroyed by fire with a loss of about $100,000.

NASHWAUK, MINN. — The Cloverdale Farmers' Club, Nashwauk, is considering plans for the erection of a transmission line for service in the rural districts.

NEW PRAGUE, MINN. — Preliminary plans under way for remodeling the municipal power plant, changing the system from direct to alternating current and extensions in distributing lines, to cost about $50,000. J. H. A. Brahtz, Builders' Exchange, St. Paul, is engineer.

WATERLOO, IOWA.—The City Council is considering replacing the cluster lamps now in use with 165 single lamps.

WATFORD CITY, N. D.—The Eastern Montana Utilities Company, Glendive, contemplates erecting a transmission line between Watford City and Fairview, Mont.

WILLISTON, N. D.—Extensions and improvements in the municipal electric power plant, including additional equipment are contemplated.

GERING, NEB.—A special election will be held on Dec. 15, to approve an issue of $28,000 in bonds, for the installation of an electric lighting system.

GRAND ISLAND, NEB.—Bids will be received by the City Council until Dec. 15, for equipment for municipal power plant and waterworks, including watertube boilers, mechanical stokers, and accessory apparatus. The Pillsbury Engineering Company, 2344 Nicollet Avenue, South Minneapolis, is engineer.

Southern States

SALISBURY, N. C.—A site has been acquired by the Southern Power Company near Salisbury on which it will erect a new 100,000-hp. steam-driven power plant. Contracts, it is understood, have been placed for most of the equipment.

SUMTER, S. C. — The Yadkin River Power Company, Raleigh, N. C., which has acquired the municipal electric plant, plans extensions to its transmission lines in this section.

ATLANTA, GA.—Bids will be received by the United States Veterans' Bureau, Room 791, Arlington Building, Washington, D. C., until Dec. 22, for construction of an administration building complete, including heating and electrical work, electric elevator, refrigerating plant and outside service connections at the United States Veterans' Hospital No. 48, Atlanta. Separate bids will be received for elevator and ice-making and refrigerating plant.

BLUE RIDGE, GA. — The Tennessee Electric Power Company, Chattanooga, plans to build a reservoir at Blue Ridge, to cost about $3,000,000. About $1,500,000 will be expended on this project next year, which will develop about 22,000 hp.

CENTER HILL, FLA.—The City Council is planning extensions and improvements in the street lighting system.

PUNTA GORDA, FLA.—The City Council has authorized an ornamental lighting system in the business district, to be installed by the Southern Utilities Company, Palatka, which has secured a franchise for light and power service here.

ST. PETERSBURG, FLA.—The installation of an ornamental lighting system on First Avenue from Beach Drive to Capac Street, consisting of fifty-two standards, has been approved by the City Commissioners.

WAYNESBORO, TENN.—Plans are being prepared by the Southern Cities Power Company, Chattanooga, for the erection of a high-tension transmission line in Waynesboro and for a temporary local plant.

BIRMINGHAM, ALA.—The installation of 150 new street lamps in the residential sections has been authorized by the City Commission. The Birmingham Electric Company has the contract for street lighting.

GUIN, ALA. — Permission has been granted the Alabama Power Company, Birmingham, to erect a transmission line (13 miles long) from Guin to Sulligent, and a distribution system in Sulligent, and also to build a line from Sulligent to Vernon, a distance of 10 miles, with a distributing system in Vernon.

LUCEDALE, MISS.—The City Council is considering the installation of additional equipment in the municipal electric plant.

PASGAGOULA, MISS.—The Mississippi Power Company, which has acquired the municipal plant, plans to erect a transmission line to Pasgagoula.

MIAMI, OKLA.—The Council is considering the installation of additional equipment in the municipal power station, includ-

ing a 750-hp. Diesel engine and accessories, to cost about $61,000. George C. Brown is city clerk.

SAND SPRINGS, OKLA. — Tentative plans are under consideration by Charles Page, operating textile mills and other local industries, for a hydro-electric development on the Illinois River, near Watts, to cost about $350,000.

BROWNWOOD, TEX. — Plans for the proposed 17-mile pipe line to be built by the Sirman Oil Company from Northern Brown County to Brownwood, include several electric power plants.

Pacific and Mountain States

BELLINGHAM, WASH. — The Farmers Mutual Light & Power Company, Bellingham, recently organized, proposes to supply electric light and power service in Birch Bay (a summer resort). James H. Milholin, Bellingham, is interested in the company.

DEER PARK, WASH. — Bonds to the amount of $60,000 have been issued by the Mount Spokane Power Company, the proceeds to be used for enlarging its power plant and extending its service lines north of Spokane. It is proposed to increase the output of the plant from 500 hp. to 1,000 hp.

KELSO, WASH. — The Puget Sound Power & Light Company, Seattle, through its Kelso branch, is erecting a transmission line to serve the Lexington district, 2 miles north of Kelso.

PORTLAND, ORE.—The City Council is considering the installation of ornamental lamps on Grand Avenue and on East Burnside Street.

PORTLAND, ORE. — Permission has been granted the Northwestern Electric Company for reconstruction and extension of its 11,000 and 2,400-volt power lines in the central east side section.

LOS ANGELES, CAL.—Plans for the proposed works of the Baash-Ross Tool Company to be erected at 5520 South Boyle Avenue, at a cost of $100,000, include a power plant. Moran Company, Kerckhoff Building, is architect.

RIVERBANK, CAL.—The Board of City Trustees is considering the installation of ornamental lamps in the business section, using part of the present system.

SAWTELLE, CAL. — Bids will be received by C. W. Wadsworth, general treasurer, at the Pacific Branch, National Home for D. V. S. Soldiers' Home, Los Angeles County, until Jan. 18, as follows: (a) For furnishing labor and material for construction (except mechanical equipment and elevators) for a hosiptal building at the Pacific Branch, N. H. D. V. S., at Sawtelle; (b) for mechanical equipment (except elevators) for the above buildings; (c) for elevators for the above building; (d) for furnishing labor and material for construction complete of the above building.

KELLOGG, IDAHO. — Steps have been taken by the Chamber of Commerce to extend the street-lighting system on Main Street and McKinley Avenue.

VERNAL, UTAH. — The hydro-electric plant and distribution system of the Vernal Milling & Light Company have been acquired by the Utah Power & Light Company, Salt Lake City. A number of extensions and improvements to the local plant are contemplated in the near future.

ISMAY, MONT.—The City Council has issued $9,000 in bonds for extensions in the street-lighting system.

Canada

COBALT, ONT.—In order to increase its power service in the Kirkland Lake gold mining district the Northern Ontario Light & Power Company is planning to erect a transmission line about 2½ miles long.

KILBRIDE, ONT. — Steps have been taken by local citizens to secure an extension of the Hydro electric service from Milton to Kilbride.

QUEBEC, QUE.—The Quebec Development Company (Duke-Price industrial project) has applied to the Public Service Commission for authority to erect a 154,000-volt transmission line, 17 miles long, to connect Maligne Island with St. Leonard, where it will serve electricity to the Aluminum Corporation of America, near the village of Alma. Later on the line will be extended to Port Alfred to supply power to industries in that section.

Electrical Patents

Announced by U. S. Patent Office

(Issued November 10, 1925)

1,561,278. WAVE SIGNALING SYSTEM; M. I. Pupin, Norfolk, Conn. App. filed Feb. 4, 1918. A receiver of high-frequency waves.

1,561,279. EQUALIZING VACUUM-TUBE AMPLIFIER; M. I. Pupin, Norfolk, Conn. App. filed Dec. 23, 1918.

1,561,284. REGULATOR SYSTEM; H. K. Sels, Pittsburgh, Pa., and T. Simmons, Homewood, Pa. App. filed April 18, 1922. Operative over a range of voltage limited only by the capacity of the machines on the system.

1,561,289. SIGNALING BY HIGH-FREQUENCY WAVES; H. J. Vennes, New York, N. Y. App. filed Sept. 29, 1919. Single-wave source furnishes carrier wave for two-way transmission.

1,561,292. AUTOMATIC TELEPHONE SYSTEM; F. Aldendorff, Berlin-Wilmersdorf, Germany. App. filed Aug. 16, 1921. Switching arrangement.

1,561,297. ALTERNATING-CURRENT ELECTRIC MOTOR; W. E. Ayres, Hale, England. App. filed Oct. 23, 1920. Induction starting and synchronous running.

1,561,303. TUMBLER SWITCH; H. G. Baxter, Baldwin, N. Y. App. filed Jan. 8, 1921.

1,561,309. COMBINED TOASTER; O. A. Colby, Irwin, Pa. App. filed Oct. 11, 1923.

1,561,316. CIRCUIT INTERRUPTER; O. H. Eschholz, Wilkinsburg, Pa. App. filed April 6, 1923.

1,561,317. HEATING DEVICE FOR INCUBATORS; W. Eshelman, Lampeter, Pa. App. filed July 10, 1923.

1,561,319. SINGLE-PHASE DISTRIBUTING METHOD AND SYSTEM; C. Le. G. Fortescue, Pittsburgh, Pa. App. filed April 13, 1922.

1,561,362. CREST VOLTMETER; J. Slepian, Swissvale, Pa. App. filed Dec. 13, 1920.

1,561,370. MOTOR-GENERATOR SET; N. W. Storer, Pittsburgh, Pa., and R. E. Ferris, Swissvale, Pa. App. filed June 14, 1923. For electric locomotives.

7,561,386. ELECTRIC CIRCUIT PROTECTOR; H. E. White, Montclair, N. J. App. filed June 14, 1921. Magnet type to protect against overload.

1,561,408. INDUCTION ELECTRIC FURNACE; R. L. Chartier, Paris, France. App. filed Aug. 21, 1923.

1,561,425. THERMOSTATIC SWITCH; H. R. Fernandez, Havana, Cuba. App. filed Oct. 7, 1924.

1,561,437. ELECTRIC HEATER; J. A. Spencer, Revere, Mass. App. filed April 8, 1921. With disk-type thermostat.

(Issued November 17, 1925)

1,561,452. SPEED-MEASURING DEVICE; C. R. Alden, Detroit, Mich. App. filed Jan. 28, 1925.

1,561,480. GENERATOR; T. M. Offutt, Connersville, Ind. App. filed Feb. 12, 1924. Steam generator, electrically operated.

1,561,483. DISTINGUISHING DIELECTRIC SHEETS; G. W. Pickard, Newton, Mass. App. filed April 23, 1920. As to quality.

1,561,495. ELECTRICAL CONNECTOR; A. C. Thompson, Spokane, Wash. App. filed Nov. 1, 1924. Two-part-plug type having means for locking the parts together.

1,561,524. TELEPHONE TESTING SYSTEM; G. Sandalls, Jr., New York, N. Y. App. filed May 20, 1924.

1,561,526. PRINTING TELEGRAPHY; G. S. Vernam, Brooklyn, N. Y. App. filed Dec. 11, 1922.

1,561,530. TELEGRAPH REPEATER CIRCUITS; E. J. Conover, Decatur, Ga. App. filed Nov. 1, 1923.

1,561,531. TELEGRAPH CIRCUITS; S. I. Cory, Elmhurst, N. Y. App. filed March 17, 1922.

1,561,532. TELEGRAPH SYSTEM; S. I. Cory, Elmhurst, N. Y. App. filed July 26, 1923.

1,561,554. MAGNETIC FIXTURE; F. B. Little Chicago, Ill. App. filed Sept. 2, 1921. For supporting a portable electric appliance.

1,561,559. ELECTRICAL SIGNALING; J. O. Mauborgne, L. Cohen and G. Hill, Washington, D. C. App. filed April 8, 1921. Radio signaling.

1,561,578. ELECTRIC HEATING ELEMENT; O. C. Trautman, Lakewood, Ohio. App. filed April 2, 1924. For electric furnaces.

1,561,591. COMBINED RADIATOR AND BOILER; L. G. Bostedo, Oak Park, Ill. App. filed July 12, 1924.

1,561,598. TELEPHONE SYSTEM; G. R. Eaton, Oak Park, Ill. App. filed Dec. 31, 1921. Multiple-line-lamp system.

1,561,599. COIN-OPERATED RECIPROCATING TIME SWITCH; L. C. Eppler, Groton, N. Y. App. filed March 19, 1923.

1,561,602. ELECTROPLATING APPARATUS; J. M. Gauss, South Bend, Ind. App. filed July 4, 1923.

1,561,624. ALTERNATING-CURRENT MOTOR; H. Weichsel,, St. Louis, Mo. App. filed Nov. 21, 1924. Self-excited synchronous-induction motor.

1,561,640. ELECTRIC SWITCH; J. F. Eyraud, Lyons, France. App. filed Feb. 14, 1921. Rotary snap switch.

1,561,706. ELECTRIC WATER HEATER; A. M. Duffie, Buffalo, N. Y. App. filed June 5, 1923.

1,561,710. TELEPHONE SYSTEM; H. M. Friendly, Portland, Ore. App. filed Dec. 21, 1916.

1,561,731. ELECTRIC ARC FURNACE; F. Kostka, Dusseldorf, Germany. App. filed Dec. 20, 1924.

1,561,786. CLOCK MECHANISM; H. M. Huemann, Wallace, Idaho. App. filed Dec. 8, 1924. In which the movement is actuated by electric impulses.

1,561,813. CIRCUIT CONTROLLER FOR FLOW INDICATORS; W. T. Williams, Topeka, Kan. App. filed Nov. 16, 1925.

1,561,814, 1,561,815. ELECTRIC HEATER AND VAPORIZER; L. E. Aske, Duluth, Minn. App. filed June 19, 1923.

1,561,819. RADIO TELEGRAPHY; R. R. Beal, Palo Alto, Cal. App. filed Jan. 5, 1920.

1,561,825. ELECTRIC SOUND-REPRODUCING DEVICE; O. Bothe, Steglitz, Germany, and L. Schiff, Berlin, Germany. App. filed June 6, 1924.

1,561,837. THERMIONIC INDICATING MEANS RESPONSIVE TO LIGHT VARIATIONS; J. J. Dowling, Rathgar, Dublin, Irish Free State. App. filed July 30, 1924.

1,561,892. REGULATING REPEATER SYSTEMS; D. F. Whiting, New York, N. Y. App. filed Feb. 15, 1921.

1,561,893. REFRACTORY HEATER PLATE; C. W. Williams, East Palestine, Ohio. App. filed Jan. 30, 1924.

1,561,912. REGISTERING SYSTEM; E. H. Clark, Richmond Hill, N. Y. App. filed June 16, 1922. Used in automatic telephone-exchange system.

1,561,914. RADIO-FREQUENCY SYSTEM; H. F. Elliott and J. A. Miller, Palo Alto, Cal. App. filed Jan. 9, 1922.

1,561,921. REGISTERING SYSTEM; J. W. Gooderham, Yonkers, N. Y. App. filed June 12, 1922. Used in automatic-telephone-exchange system.

1,561,933. SOURCE OF ALTERNATING CURRENT; B. W. Kendall, New York, N. Y. App. filed Aug. 7, 1918. Alternating-current generators employing vacuum-tube amplifiers.

1,561,936. TELEPHONE-EXCHANGE SYSTEM; W. C. Kiesel, New York, N. Y. App. filed Oct. 31, 1919. Private-branch-exchange systems employing both manual and automatic facilities.

1,561,951. TESTING DEVICE; L. J. Stacy, Caldwell, N. J. App. filed Sept. 17, 1924. For relays.

1,561,969. SECTOR SWITCH; J. B. Chrabkow, Cincinnati, Ohio. App. filed Oct. 14, 1924. Multiple circuit.

1,562,020. ELECTRIC SWITCH; W. G. Williams, Brandon, Wis. App. filed May 8, 1925. Time-delay type.

1,562,021. ELECTRIC COOKER; H. A. Ziola, Toledo, Ohio. App. filed March 28, 1925.

1,562,039. BURGLAR ALARM; J. Nowakowski, Milwaukee, Wis. App. filed Oct. 9, 1923.

1,562,056. RADIO-RECEIVING SYSTEM; C. W. Rice, Schenectady, N. Y. App. filed April 21, 1921.

1,562,090. ELECTROLYTIC CELL; W. Hoopes, Pittsburgh, Pa. App. filed Nov. 8, 1923.

1,562,164. PROCESS OF COATING ELECTRODES; J. E. Harris, East Orange, N. J. App. filed March 4, 1920.

1,562,172. ELECTRON-DISCHARGE DEVICE; W. G. Housekeeper, New York, N. Y. App. filed Aug. 30, 1920.

1,562,183. ELECTRIC SWITCH; C. Norton, South Orange, N. J. App. filed Feb. 2, 1923. As used in connection with elevator-door-operating mechanisms.

1,562,188. SELECTING SYSTEM; P. M. Rainey, Glen Ridge, N. J. App. filed Aug. 17, 1920.

1,562,189. PRINTING-TELEGRAPH SYSTEM; P. M. Rainey, Glen Ridge, N. J. App. filed Dec. 30, 1921.

1,562,193. SUBMARINE SOUND SIGNALING OR INDICATING APPARATUS; C. P. Ryan, East Molesey, England. App. filed Jan. 12, 1924.

1,562,200. ELECTROMAGNETIC DEVICE; W. O. Beck, Ridgefield, N. J. App. filed Aug. 29, 1923. Time-delay switch.

Financial and Corporate

Utility Stocks Irregular

Small Declines and Gains About Evenly Divided in Week of Moderate Trading

DURING the week that included the Thanksgiving holiday trading in all markets was comparatively slow and price movements generally were limited. Opinion was divided on the matter of the probable action of the New York Reserve Bank, as it has been ever since Boston, Cleveland, Philadelphia and San Francisco all raised their discount rates from 3½ to 4 per cent. Wall Street in some quarters is fearful of the effects of an increase in the New York rate and in other quarters is anxious to get the ordeal over.

On the big board American Water Works & Electric Company's common shares continue to be one of the most spectacular movers and early this week rose to a level above 68, which about equals the previous high record and compares with a price below 50 for the recent decline. For the most part, of course, the changes were relatively small, and the small gains and small declines were fairly evenly distributed.

While Washington Railway & Electric gained eight points during the week, it must be remembered that trading in that issue is distinctly limited. Typical of the gains for the week were the advances of approximately a point in such issues as Central States Electric preferred, Mohawk & Hudson and numerous other preferred and common issues. On the curb attention was given to Electric Railway Securities, for the fact that distribution would be made of preferred stock, common stock and options of the newly created Utility Shares Corporation to holders of the former Electric Railway Securities common shares was announced. The new issues have been listed on the curb.

Losses were sustained by American Gas & Electric preferred, Eastern Texas, Galveston-Houston and Puget Sound Power & Light.

Southern Public Utilities Company in New Control.—The Southern Public Utilities Company, which retails electrical energy for lighting and power purposes in more than a dozen cities of North and South Carolina and operates street-railway and gas systems in a number of them, has been acquired by Southern Power interests, according to an announcement made by George Allen of New York, who recently succeeded the late James B. Duke as president of the Southern Power Company. The Utilities company had been one of the group of Duke companies, but had no direct corporate or fiduciary connection with the Southern Power Company. "The plan which has just been consummated," said Mr. Allen, "brings about the complete unity of actual control that has heretofore been absent." The change will not affect the corporate entity of the Utilities company, which is headed by E. C. Marshall, Charlotte.

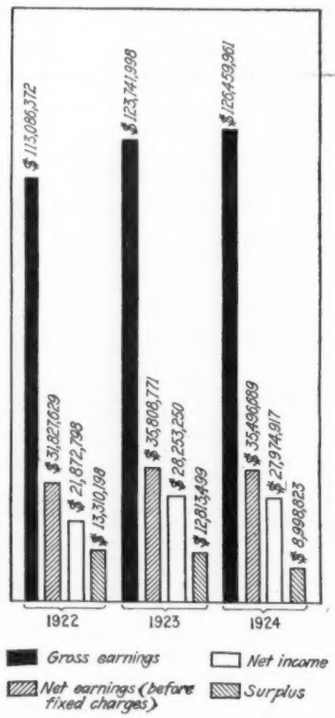
Listings.—The New York Stock Exchange has authorized the listing of the following securities: Brooklyn Edison, $15,000,000 additional capital stock (par $100); North American Company, $1,991,550 additional common stock (par $10); Sierra & San Francisco Power, $3,000,000 additional first mortgage 5 per cent forty-year gold bonds, and Utica Gas & Electric, $2,110,000 additional refunding and extension mortgage 5 per cent fifty-year gold bonds. The Baltimore Stock Exchange has authorized the listing of 140,257 shares (without par value) additional common stock of the Consolidated Gas, Electric Light & Power Company of Baltimore.

Consolidated Gas Company of New York

Parent Utility Is 103 Years Old—New York Edison Company, Its Chief Subsidiary, Organized in 1901—Combined Assets Are $606,000,000

BY PAUL WILLARD GARRETT

ALMOST 103 years ago, on March 26, 1823, the State Legislature sanctioned the issuance of a charter to the Gas Light Company of the City of New York, and about a month later the company obtained permission to lay mains in the streets on the condition that service would be available within two years for the district from the Battery to Canal Street. From that meager beginning grew the present Consolidated Gas Company of New York, which today serves all of Manhattan, all of the Bronx and a part of Queens with light, power and gas. Although the organization began as one interested primarily in the manufacture and sale of gas, it is now, through its ownership of New York Edison Company shares, one of the largest power and light utilities in the world. Certainly no other utility in the world is so distinguished for the compactness of the territory served and, excepting holding companies that do business in several jurisdictions, no other utility is so large.



GROSS AND NET EARNINGS OF CONSOLIDATED GAS COMPANY FOR THREE-YEAR PERIOD

The question frequently is asked: Why have not the shares of the New York Edison Company, recognized to be a leader in its particular class, not received more attention in the recent bull market for utility stocks? The simplest answer is, of course, that all of the stock is held by the Consolidated Gas Company of New York. The only way to buy an interest in the New York Edison Company, in other words, is to buy shares of the Consolidated Gas Company, and litigation over the "dollar-gas" law has created uncertainty and misunderstanding in the minds of certain investors.

WIDESPREAD EQUITIES

As a matter of fact, it is difficult to find securities in the utility group for which such wide equities may be found as for the securities of the Consolidated Gas Company. To ascertain these equities it is necessary to study a consolidated balance sheet, for in 1901 the New York Edison Company was formed through a merger of the former New York Gas & Electric Light, Heat & Power Company and the Edison Illuminating Company of New York. The combined balance sheet for the end of 1924 showed land, plant and equipment assets of $553,915,621 and total assets of $606,964,659. At that time the combined balance sheet showed a funded debt of $120,497,790, unfunded debt of $50,307,207 and capital stock outstanding to the amount of $233,963,585. That there were enormous margins of safety may be seen from such items, for ex-

ample, as the $55,016,202 fund reserved for contingencies and the $113,827,300 for surplus.

Turning to the balance sheet of the Consolidated Gas Company itself, we find a rather simple capital structure. There are $50,000,000 in long-term debenture bonds (maturing in 1945), $15,000,000 in preferred stock and 3,600,000 shares of no-par common stock. The last-named issue has an unbroken dividend record dating back to 1892. In 1922 the old $100 par-value stock was exchanged on the basis of two for one, and the new stock has been maintained on a five-dollar dividend basis ever since. Voiding of the "dollar-gas" law would release $7,000,000 in impounded funds for distribution to stockholders or for corporate purposes. The last annual report of the company shows that 1924 taxes aggregated $13,842,991, or equivalent to 12.65 cents on each 100 cu.ft. of gas sold in the year and to a half cent for each kilowatt-hour of electrical energy sold.

Few Light and Power Bonds in Default.—A recent compilation made by Dow, Jones & Company of public utility corporation bonds at present in default is evidence of the admirable record electric light and power companies have established in meeting their obligations. Out of a total of seventy-six companies, with securities in default to the amount of $164,727,800, only three strictly electric light and power companies were represented, with bonds in default totaling $3,064,900. These companies include the Commonwealth Power Company of Nebraska, the Pensacola Electric Company, which has recently been acquired by the Southeastern Power & Light Company, and the Hortonia Power Company of Brandon, Vermont.

New Capital Issues

During the past week the Electric Public Service Company made an offering of one year 5 per cent collateral gold notes totaling $1,000,000, the price being 99 and interest to yield 6 per cent. The company will serve directly or through its subsidiaries electric light and power and gas in fifteen different communities in Ohio and Oklahoma. The population served is about 40,000. These bonds are dated December 1, 1925, and mature December 1, 1926.

The Kentucky Utilities Company was represented with a two-million-dollar offering of first mortgage lien 5½ per cent gold bonds, series F, priced at 98½ and interest, yielding about 5.60 per cent. Pennsylvania Gas & Electric Corporation issued 75,000 shares of class A participating stock at $22.50 per share.

Eastern Texas to Issue Stock and Notes.—A meeting of stockholders of the Eastern Texas Electric Company, managed by Stone & Webster, Inc., Boston, will be held on December 14 to approve the issue of 47,000 additional shares of common stock at $50 each and $3,500,000 in five-year, 5.5 per cent convertible notes at $95 each. The new common will be offered to existing stockholders in the proportion of one share to each four now held.

Company Reports

The following statement of earnings have been issued by electric light and power companies for the month of October:

Name of Company	Gross Earnings for October 1925	1924
Alabama Power	$1,181,914	$816,912
Bangor Hydro-Electric	133,444	128,801
Binghamton Lt., Ht. & Pwr.	148,091	126,903
Commonwealth Power	3,950,046	3,254,562
Consumers' Power	1,864,005	1,508,186
Electric Power & Light	3,692,987	3,334,463
Florida Public Service	96,010	59,826
Fort Worth Power & Light	244,342	260,854
Kansas Gas & Electric	373,531	442,846
Manchester Trac., Lt. & Pwr.	216,068	205,260
Metropolitan Edison	788,829	669,847
Nebraska Power	365,901	336,680
New Jersey Power & Light	127,065	97,238
Newport News & Hampton Railway, Gas & Electric	170,393	166,024
North Carolina Pub. Service	159,759	148,403
Northern Ohio Power	965,603	869,153
Pacific Power & Light	314,123	267,563
Pennsylvania Edison	278,780	239,738
Portland Electric Power	910,436	885,169
Public Service Corp. of N. J.	8,483,550	7,920,471
Republic Railway & Light	970,512	853,562
Sayre Electric	24,347	17,444
Southern California Edison	2,135,496	1,912,194
Tennessee Electric Power	1,005,278	800,057
Texas Power & Light	643,822	611,743

November Offerings Total $66,451,500

NEW issues of stocks, bonds and notes by the electric light and power companies of the country aggregated $66,451,500 during the month of November, as compared with $73,232,500 in October and $106,640,000 in November of the previous year. The eleven-month period closed with a total considerably in advance of that recorded for the same period of 1924—$908,726,010 against $898,009,700.

Most of the money raised during November by the sale of these securities represented new capital, though refunding was by no means a negligible factor in the month's activities. Long-term financing predominated, only one short-term issue appearing in the month's flotations. There was one offering of serial gold bonds made by the Feather River Power Company maturing in from three to thirty-eight

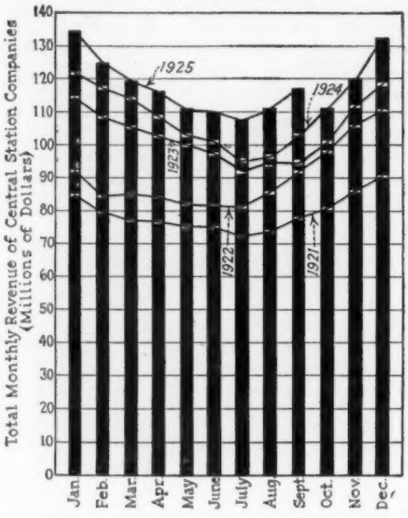
SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN NOVEMBER

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Eastern States Power Corp. (Md.)	$3,900,000	..	Preferred stock, series A	To acquire securities	7	97½	7.15
Gulf Public Service Co. (Del.)	1,500,000	20	First mortgage sinking-fund gold bonds, seri A	Acquisition of properties	6	97½	6.22
Interstate Public Service Co. (Ind.)	2,825,000	25	First mortgage and refunding gold bonds, series C	To remburse for new properties acquired, refunding and for other corporate purposes	5½	97½	5.70
Madison Gas & Electric Co. (Wis.)	2,200,000	25	General and refunding mortgage gold bonds	To retire bonds, to reimburse for capital expenditures and for construction	5	98.60	5.10
Southern Cities Utilities Co. (Tenn.)	1,500,000	15	Secured gold bonds, series A	To acquire securities of other utilities	6½	98	6.70
Midland Utilities Co. (Ill.)	3,000,000	1–3	Serial gold notes	To reimburse for development of properties and for other corporate purposes	4½ to 5	99½ to 100	4.75 to 5.10
Kaministiquia Power Co., Ltd. (Ont.)	2,026,500	25	First mortgage sinking-fund gold bonds, series A		5½	99	5.57
Northern Canada Power, Ltd. (Ont.)	6,000,000	20	First mortgage sinking-fund gold bonds, series A	Refunding and for additions	6	100	6
American Water Works & Electric Co. (N. Y.)	8,000,000	50	Gold debentures, series A	To reimburse for expenditures on acquisition of properties, for additional working capital and for general corporate purposes	6	94½	6.35
Southern Ohio Electric Co	2,000,000	30	First mortgage gold bonds	Acquisition of properties	6	100	6
Feather River Power Co. (Cal.)	5,500,000	3–38	First closed mortgage serial gold bonds	Construction	6	100	6
Georgia Railway & Power Corp.	4,000,000	..	Cumulative first preferred stock	Additions and improvements and for acquisition of new property	7	100	7
United Light & Power Co. (Md.)	12,500,000	50	Gold debentures	Acquisition of and improvements to properties and for other corporate purposes	6	92	6.55
Columbus Railway, Power & Light Co. (Ohio)	2,500,000	..	Cumulative first preferred stock	Partial retirement of floating debt and for construction	6	100	6
Virginia Electric & Power Co.	3,000,000	30	First and refunding mortgage gold bonds	Acquisition of securities	5	92½	5.50
Penn-Ohio Edison Co.	6,000,000	25	Gold debentures, series A	To retire certain debt of company and its subsidiaries and for other corporate purposes	6	96½	6.25
Total	$66,451,500						

years. The largest individual issue was offered by the United Light & Power Company in the form of fifty-year gold debentures, a piece of financing involving a total of $12,500,000. The average yield, after declining sharply to 6.00 per cent in October from 6.63 per cent in September, made a recovery to the 6.19 per cent mark in November.

Stockholders Vote Approval of Merger.—Another step in the merger of the National Power & Light Company with the Carolina Power & Light Company was taken this week, when stockholders of the former company approved a consolidation of their company with the United Investors' Securities Company. All of the stock of the United Investors' Securities Company, except for directors' shares, has been exchanged for Carolina Power & Light Company common stock. Former Carolina Power shareholders, as United Investors' shareholders, must approve the consolidation of the United Investors' Securities Company with National Power, and this approval was assured because as United Investors' shareholders they have already executed proxies in favor of the consolidation.

September Revenue Totals $117,200,000



Reports received by the ELECTRICAL WORLD from central-station systems totaling 70 per cent of the total generator rating of the industry indicate that the gross revenue from the sale of energy during the month of September was $117,200,000, an increase of $14,200,000, or 13.7 per cent, over September of last year. The gross revenue for the first nine months indicates that the gross revenue for the year 1925 will total approximately $1,470,000,000.

The operating expenses totaled $55,900,000 in September against $51,100,000 in September last year.

California-Oregon Power to Increase Funded Debt.—Stockholders of the California-Oregon Power Company have voted to increase the authorized funded debt from $12,000,000 to $50,000,000.

Western Power Elects New Directors.—Following the acquisition of control of the Western Power Corporation by the North American Company, the following directors were elected to fill vacancies caused by retirement: Frank L. Dame, Frederick W. Doolittle, James F. Fogarty, Carl R. Ganter, Edwin Gruhl, C. W. Hough, Henry H. Pierce, Frederick H. Piske and Robert Sealy. Frank L. Dame was also elected chairman of the board, Edwin Gruhl vice-president, Robert Sealy treasurer, and Frederick H. Piske secretary.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Nov. 28	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	f71¼	62	75¼
Adirondack Pwr. & Lt.—7% pf.	101	98	106
Adirondack Pwr. & Lt.—8% pf.	107	103	115
Adirondack Pwr. & Lt., com.—50	l 75	31	98
Ala. Pwr., pf.	104	97½	103
Allis-Chalmers Mfg. pf.	107	103½	108½
Allis-Chalmers Mfg., com.	f 89½	71½	95
Amer. & Foreign Pwr., pf. 25% pd.	130	129½	142
Amer. & Foreign Pwr., 7% pf.	f 92½	87	94
Amer. & Foreign Pwr., com.	f 41½	27½	51½
Amer Bosch Magneto, com.—no par	f 32½	26¼	54½
Amer. Brown, Boveri, ptc., stk.	f 49½	49½	53½
Amer. Elec. Pwr., pf.	c 101½	91½	104½
Amer. Gas & Elec., 6% pf.—no par	90½	85	91
Amer. Gas & Elec., com.—no par	78	70	85
Amer. Lt. & Trac., 6% pf.	114	93	115
Amer. Lt. & Trac., com.	270	139	288
Amer. Pwr. & Lt., 6% pf.	94	84	95
Amer. Pwr. & Lt., com.—no par	60	52	67½
Amer. Pub. Serv., 7% pf.	96	88	96
Amer. Pub. Serv., com.	47	45	90
Amer. Pub. Utilities, 4% pf.	80	....	....
Amer. Pub. Utilities, 6% pf.	80	71	82
Amer. Pub. Utilities, 7% pf.	87	87	95
Amer. Pub. Utilities, com.	78	70	103
Amer. Superpwr., pf.—25	f 25½	....	....
Amer. Superpwr., Class A—no par	f 33	....	....
Amer. Superpwr., Class B—no par	f 35	....	....
Amer. Wtr. Wks. & Elec., 7% pf.	f101	98	103
Amer. Wtr. Wks. & Elec., com.	f 69½	34½	69½
Appalachian Pwr., 7% pf.	101	92	100
Appalachian Pwr., 1st pf., 7%	101	95	101
Appalachian Pwr., com.—no par	78	70	83
Arizona Pwr., 7% pf.	82	75	87
Arizona Pwr., com.	32	15	34½
Arkansas Cent. Pwr., pf., $7—no par	100	97	102
Arkansas Lt. & Pwr., 7% pf.	98	92	102
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	k101½	98	104
Assoc. Gas & Elec., 7% pf.—1% extra—50	f 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	l 82	....	....
Assoc. Gas & Elec., Class A	f 33½	....	....
Babcock & Wilcox, com.	f 144	....	....
Birmingham Elec. pf.—$7—no par	102	98	103
Blackstone Valley Gas & Elec., com.—50	94	....	....
Blaw-Knox, com.	i 60	59	60
Brazilian Trac., Lt. & Pwr., com.	l 75½	....	....
Broad River Pwr., pf.	94	90	97
Brooklyn Edison, com.	f 136½	120½	156½
Buffalo Gen. Elec., com.—no par	l 58	50	77
Buffalo, Niagara & East. Pwr., pf.—25	f 24	....	....
Buffalo, Niagara & Eastern Pwr., com.	f 30	....	....
Carolina Pwr. & Lt., pf.—$7—no par	105	100	107
Carolina Pwr. & Lt., com.	430	290	456½
Central & S. W. Utilities, 7% pf.—no par	a 88½	88	90½
Central & C. W. Utilities, pr. In. pf.—no par	a 98½	96½	100
Central Ariz. Lt. & Pwr., pf.	101	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98½
Central Ill. Pub. Serv., 6% pf.	86	84	93
Central Ind. Pwr., 7% pf.	86	88	95
Central Pwr. & Lt., pf.	94	88	95
Central States Elec., 7% pf.	94	87	98
Central States Elec., com.	220	70	225
Century Elec., com.	l 103	103	110
Chicago Fuse Mfg., com., no par	a32	27½	39½
Cincinnati Gas & Elec., com.	l 89½	82	90½
Cities Service, 6% pf.	84	80	84
Cities Service, pf. B—10	f 7½	....	....
Cities Service, pf. BB—100	f 76	....	....
Cities Service, com.—20	38½	34	43
Cities Service, Bka. Shrs.—10	17½	16½	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	96	93	98
Columbia Gas & Elec., 7% pf.	112½	104½	113¾
Columbia Gas & Elec., com.—no par	f79½	45½	86
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	f100	....	....
Columbus Elec. & Pwr., com.	f 150	....	....
Columbus Ry., Pwr. & Lt., pf. A	98	86	99
Columbus Ry., Pwr. & Lt., pf. B	92	80	85
Columbus Ry., Pwr., & Lt., com.	150	114	150
Commonwealth Edison, com.	a137½	130½	141½
Commonwealth Pwr., 6% pf.	87	80	88
Commonwealth Pwr., com—no par	35	30½	43½
Conn. Lt. & Pwr., 8% pf.	118	115	118
Conn. Lt. & Pwr., 7% pf.	111	105	110
Cons. Gas of N. Y., pf.—50	f 56½	....	....
Cons. Gas of N. Y., com—no par	f 92½	74½	95½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	c103½	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e109	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c111	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c125½	122	127½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	c 42½	32	47½
Cons. Utilities of Dela., 7% pf.	l85	80	84
Consumers Pwr., 6% pf.	96½	90	97
Consumers Pwr., 6 6% pf.	102	97	102
Continental Gas & Elec., 7% ptc. pf	95½	85	97
Continental Gas & Elec., 7% pr. pf.	96	89	95
Continental Gas & Elec., com—no par	140	77	145
Crocker Wheeler, com.	15	21	28
Crocker Wheeler, pf.	..	65	80
Dallas Pwr. & Lt., 7% pf.	102	100	102½
Dayton Pwr. & Lt., 6% pf.	95	88	100
Dayton Pwr. & Lt., com.	420	180	460
Detroit Edison, com.	137	110	159½
Dubilier Condenser & Radio, com.	j 10½	....	....
Dubuque Elec., 7% pf.	91	80	90
Duquesne Lt., 7% pf.	109	104	112
East. Tex. Elec., 7% pf.	100	100	105
East. Tex. Elec., com.—no par	80	70	75½
Edison Elec. Illum. of Boston, com.	d209½	200	213
El Paso Elec., com.	f 78	....	....
El Paso Elec., pf.	f100	....	....
Elec. Bond & Share, 6% pf.	k103½	101½	106½
Elec. Bond & Share Sec., com.—no par	k 66½	56½	80½
Elec. Investors, 6% pf—no par	92	95	96
Elec. Investors, com.—no par	68	30	79½
Elec. Investors, 10% pd. receipts	50	15	62
Elec. Pwr. & Lt., ctfs. pf.	f 92½	89½	94
Elec. Pwr. & Lt., ctfs., 40% pd.	f106½	100	110
Elec. Pwr. & Lt., ctfs. full pd.	f108½	100½	110½
Elec. Pwr. & Lt., ctfs., com.	f 29½	17½	40½
Elec Ry. Securities, com—no par	26	....	....
Elec. Storage Battery, com.—no par	f 77	60½	77
Elmira Wtr., Lt. & R.R., 7% pf.	96½	93	98
Emerson Elec., pf.	b100	95	101½
Empire Dist. Elec., 6% pf.	80	78	85
Engr. Pub. Serv., pf.—no par	99	100	103
Engr. Pub. Serv., com.—no par	24	19½	30
Eureka Vacuum Cleaner, com.—no par	f 52½	48½	55½
Fairbanks Morse, com.	f 48½	32½	54½
Fairbanks Morse, pf.	l 110½	106½	110½
Federal Lt. & Trac., com.	f 33½	26	36
Federal Light & Traction, pf.	f 85½	82½	86½
Federal Utilities, pf.	f 75	....	....
Federal Utilities, com.	f 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	k105	99½	107½
Galveston-Houston Elec., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par	25	20	40
Gen. Elec., com.	f 308	227½	337½
Gen. Elec., special—10	f 11½	10½	11½
Gen. Gas & Elec., 6% pf.—no par	200	72	240
Gen. Gas & Elec., 7% pf.	165	120	175
Gen. Gas & Elec., com.—no par	210	72	240
Gen. Gas & Elec., (Me.) pf.—$8—no par	130	90	175
Gen. Gas & Elec., (Me.) pf.—$7—no par	140	104½	180
Gen. Gas & Elec. (Del.) com. A no par	57½	42	64½
Gen. Gas & Elec. (Del.) com. B no par	56	40	62
Gen. Gas & Elec. (Del.) A pf. 7% no par	95	97½	100
Gen. Gas & Elec. (Del.) A pf. 8% no par	107	90	110
Gen. Gas & Elec. (Del.) B pf. 7% no par	94	88	96
Ga. Lt., Pwr., & Rys., 6% pf.	75	74	85
Ga. Lt., Pwr. & Rys., com.	60	25	74
Ga. Ry. & Elec., 5% pf.	l 76	78½	84½
Ga. Ry. & Elec., com.	l 124½	115½	115½
Ga. Ry. & Pwr., 8% pf.	j 112	....	....
Ga. Ry. & Pwr., 7% pf.	j 100½	....	....
Ga. Ry. & Pwr., 4% pf.	130	62	140
Ga. Ry. & Pwr., com.	135	62	145
Gt. Western Pwr., 7% pf.	j 101½	....	....
Havana Elec. Ry., Lt. & Pwr., com.	l 236	112	246
Havana Elec. Ry., Lt. & Pwr., pf.	l 112	112	116
Hurley Machine, com.—no par	a 48½	41½	56
Idaho Pwr., 7% pf.	100½	97½	102
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	96½	92½	98
Int. Combustion Engr., com.—no par	j 64½	31½	64½
Int. Utilities, class A—no par	j 39	....	....
Int. Utilities, class B—no par	j 7½	....	....
Interstate Pwr., pf., $7, no par	90	90	95
Interstate Pub. Serv., 7% pf.	96	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
Jersey Central Pwr. & Lt., 7% pf.	94	90	96
Jersey Central Pwr. & Lt., com.—no par	45	15	50
Johns-Manville, com.—no par	j148	....	....
Kansas Gas & Elec., 7% pf.	k101	97½	103
Kelvinator Corp., com.—no par	f 78½	....	....
Kentucky Hydro-Elec., com.	a 91	85½	92½
Kentucky Sec., 6% pf.	74	67	78
Kentucky Sec., com.	82	77	87
Kentucky Utilities, 6% pf.	89	82	95
Kings County Ltg., 7% pf.	j100	....	....
Laclede Gas Lt., com.	160	110½	178
Lehigh Pwr. Sec., cap.—no par	180	82	188

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. iPittsburgh. jBid, low, high, Tuesday, Dec. 1. kBid, low, high, Wednesday, Dec. 2. lLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Nov. 28	Low 1925	High 1925
STOCKS—Continued			
Long Island Ltg., 7% pf.	105	100	105
Long Island Ltg., com—no par.	135	60	142
Los Angeles Gas & Elec., 6% pf.	95	90	98
Manila Elec., com.—no par	36½	28½	49½
Maytag Mfg., com.	*f* 22	21¼	26½
Memphis Pwr. & Lt., pf., $7, no par	102	98½	102
Metropolitan Edison, pf.—$6—no par	92	92	96
Metropolitan Edison, pf., $7, no par	104	100	110
Middle West Utilities, 7% pf.	*a* 97½	91½	98½
Middle West Utilities, 7% pr. lien pf.	*a*107	98	108
Middle West Utilities, com.—no par	*a*113½	92½	125
Midland Utilities, pr. ln. pf.	*a*100	98½	101
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	98	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	86½	83½	87
Minn. Pwr. & Lt., 7% pf.	*k*101	97½	102
Miss. Pwr. & Lt., pf.	*j*100	....	....
Miss. River Pwr., 6% pf.	94	87½	94
Miss. River Pwr., com.	108	37	124½
Montana Pwr., pf.	*l*112½	109	117¾
Montana Pwr., com.	*j* 81½	64	99½
Montreal Pwr., com.	*j* 208½	....	....
Mountain States Pwr., pf.	*j* 94	....	....
Mountain States Pwr., com.	*j* 27	....	....
National Carbon, com.	*l*124	120	130
National Carbon, pf.	*a*125	120	130
National Elec. Pwr., pf.	*a* 94	94	96½
National Lt., Ht. & Pwr., 5% pf.	71	40	72
National Lt., Ht. & Pwr., com.—no par	24	11	30
National Pwr. & Lt., pf., $7—no par	102	95	99
National Pwr. & Lt., com.—no par.	425	185	467
National Pub. Serv., 7% pf.	*j* 93	....	....
National Pub. Serv., pfc. pf.	*j* 98	....	....
National Pub. Serv., A com.—no par	*j* 23½	....	....
National Pub. Serv., B com.—no par	*j* 15½	....	....
Nebraska Pwr., 7% pf.	*k*103	98½	103½
Nevada-Calif. Elec., com.	*j* 35½	....	....
N. J. Pwr. & Lt., 7% pf.	104	92	102
New Orleans Pub. Serv., 7% pf.	101	94	102
New Orleans Pub. Serv., com.—no par	*l* 30	31	38½
N. Y. Central Elec., 7% pf.	97	96	101
Niagara Falls Pwr., 7% pf.—25	27½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	*l* 106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par.	*l* 63	60	73
Nizer Corp., A.—no par	80	37	84
Nizer Corp., B.—no par	*j* 79½	....	....
No. Amer., 6% pf.—50	*j* 49½	46½	50½
No. Amer., com.—10	*j* 68½	41½	75
No. Caro. Pub. Serv., pf.—$7—no par.	90	90	96
No. N. Y. Utilities, 7% pf.	*j* 103	....	....
No. Ohio Pwr., com.—no par.	14	5	19
No. Ohio Trac. & Lt., 6% pf.	73	64	75
No. Ont. Lt. & Pwr., pf.	75	68	78
No. Ont. Lt. & Pwr., com.	48	41	52
No. States Pwr., 7% pf.	99½	95	100
No. States Pwr. com.	138	103	144½
No. Texas Elec., 6% pf.	50	60	75
No. Texas Elec., com.	40	40	70
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	93	85	95
Ohio Pub. Serv., 7% pf.	97½	97	100
Ohio River Edison, 7% pf.	97	93½	100½
Oklahoma Gas & Elec., pf.	*j* 93	....	....
Pacific Gas & Elec., 6% pf.	97	92	99
Pacific Gas & Elec., com.	*l*129½	102½	137½
Pacific Pwr. & Lt., 7% pf.	*k*98½	97½	102
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.—no par	*c*72	60	72
Penn-Ohio Elec., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	97	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	102	101	110
Penn Pwr. & Lt.—$7—no par.	*k*105	98½	106½
Penn Pub. Serv., 7% pf.	96	90	100
Penn Pub. Serv., 6% pf.	85	80	90
Penn Wtr. & Pwr., cap.	160	120	178
Phila. Co., pf.—50 (Pitts.)	*c* 47½	37½	49½
Phila. Co., com.	*c* 50½	51½	64½
Phila. Elec., com.	*c* 46½	37½	49½
Pittsburgh Utilities, pf.	14½	12½	17½
Portland Elec. Pwr., 7% pf.	98	95	99
Portland Elec. Pwr., 6% pf.	72	70	80
Portland Elec. Pwr., com.	43	40	53
Portland Ry., Lt. & Pwr., pf.	*l* 72	....	....
Portland Ry., Lt. & Pwr., com.	*l* 41	....	....
Pwr. Corp. of N. Y., 7% pf.	*l*110	96	112
Pwr. Corp. of N. Y., com—no par	73	15	89½
Pwr. Sec., pf.—no par.	20	20	55
Pwr. Sec., com.—no par.	14	8	30
Pub. Serv. of N. J., 7% pf.	105	99	106
Pub. Serv. of N. J., 8% pf.	*j*118½	109	119
Pub. Serv. of N. J., com—no par.	*j* 82½	62½	87½
Pub. Serv. of No. Ill., 6% pf.	*a* 98	92	100
Public Serv. of No. Ill., 7% pf.	*a*111	102	111
Pub. Serv. of No. Ill., com.—no par	*a*128	107½	128½
Pub. Serv. of No. Ill., com.	*a*127½	118	128½
Pub. Serv. of Okla., 7% pf.	93	87	95
Pub. Serv. Elec. & Gas, 6% pf.	*j* 99½	92½	99½
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	*j* 84	....	....
Puget Sound Pwr. & Lt., com.	48	49	61
Radio Corp. of Amer., pf.—50	46	45½	54
Radio Corp. of Amer., com.—no par	*j* 41¾	39½	77½
Republic Ry & Lt., pf.	86	70	85
Republic Ry. & Lt., com.	62	49	65
Rochester Gas & Elec., 5% pf.	95	80	98
Servel Corp., Class A	*j* 31½	....	....
Servel Corp., Class B—no par	56	35	62½
Sierra Pacific Elec., com.	*j* 25	....	....
Sioux City Gas & Elec., 7% pf.	*j* 99	....	....
Southeastern Pwr. & Lt., 7% pf—no par.	97	90	100
Southeastern Pwr. & Lt., com—no par	30	28	34½
So. Calif. Edison, 8% pf.	135	115	128
So. Calif. Edison, 7% pf.	110½	105	107½
So. Calif. Edison, 6% pf.	97½	90	95½
So. Calif. Edison, com.	127	102	149
Southern Cities Utilities, 7% pf.	81	77	100
Southern Cities Utilities, com.	40	30	71
Southern Pwr. & Lt. of Md., pf.	*j*107	....	....
Southern Pwr. & Lt. of Md., com.	*j* 32	....	....
Southwestern Pwr. & Lt., A.	*j* 50	....	....
Southwestern Pwr. & Lt., B.	*j* 31	....	....
Southwestern Pwr. & Lt., 7% pf.	99½	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	96	92	93
Standard Gas & Elec., 8% pf.	*l* 55½	50½	56½
Standard Gas & Elec., 7% pf.	100½	96	100
Standard Gas & Elec., com.—no par	*j* 56½	40½	61
Standard Pwr. & Lt., 7% pf.	108	95	114½
Superheater, com.—No par.	142	120	152
Tampa Elec., com.	*j*276	....	....
Tenn. Elec. Pwr., 6% pf.	84	80	85
Tenn. Elec. Pwr., 7% pf.	99	93	103
Tenn. Elec. Pwr., pf.—$6—no par.	*l* 80	72	84
Tenn. Elec. Pwr., com.—no par.	*l* 65	....	....
Tex. Pwr. & Lt., 7% pf.	*k*102	99½	106
Tide Water Pwr., 8% pf.	*j* 98	....	....
Timken Roller Bearing, com.	*j* 54	37½	59½
Toledo Edison, 8% pf.	114	109	114
Toledo Edison, 7% pf.	101	94	101½
Toledo Edison, com.	25	21	25
Tri-City Ry. & Lt., 6% pf.	87	82	85
United Gas & Elec., 6% pf.	91	80	94
United Gas & Elec., com.—no par.	55	26	57½
United Gas & Elec. (N. J.), 5% pf.	64	55	65
United Gas Impr —50.	*c*115	79½	120½
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par.	92	83	99
United Lt. & Pwr., com., A—no par.	148	42	166½
United Lt. & Pwr., com., B—no par.	160	49	100
Utah Pwr. & Lt., 7% pf.	*k* 99	97½	101½
Utica Gas & Elec., 7% pf.	103	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	92	90	97
Utilities Pwr. & Lt., com. B—no par	18	12	22
Vermont Hydro-Elec., 7% pf.	92	87	96
Virginia Pwr., 7% pf.	99	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	*l*149	64½	150
Wagner Elec., pf.	*b* 86	79	92
Wagner Elec., com.—no par	*b* 35	26½	50
Washington Wtr. Pwr., com.	129	110	140
West Mo. Pwr., 7% pf.	*j* 91	....	....
West Penn., 7% pf.	*j* 97	94	100
West Penn, com.	*j*116	97	145
West Penn Pwr., pf.	*l*108½	104	111
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94½	96½
West Va. Utilities, 7% pf.—50	41	38	47
Western Elec., 7% pf.	*k* 83	110	117½
Western Pwr., 7% pf.	96	84	....
Western Pwr., com.—no par	80	74	102
Western States Gas & Elec., 7% pf.	88	82	92
Western States Gas & Elec., com.	*j* 19	....	....
Westinghouse Elec. & Mfg., com.—50	*j* 73½	66½	84
Weston Elec. Instrument, Cl. A	27½	19½	28½
Weston Elec. Instrument, com.	*j* 17½	9½	20½
Wis.-Minn. Lt. & Pwr., 7% pf.	*i* 90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	76½	76	88
Worthington Pump, pf. B	62	58	76½
Worthington Pump, com.	*j* 42	35½	79½
Yadkin River Pwr., 7% pf.	*k*103	98	106
Yale & Towne, com.—25	*j* 65	62	70½

BONDS

Abitibi Pwr. & Paper	6s	1940	100	98	101½
Adir. Elec. Pwr.	5s	1962	99½	97½	100½
Adir. Pwr. & Lt.	6s	1950	104½	102½	105½
Adir. Pwr. & Lt.	5s	1930	97	94	98
Ala. Pwr.	5s	1946	98½	96	100
Ala. Pwr.	5s	1951	95½	92½	97½
Ala. Pwr.	6s	1951	104½	101½	105
Ala. Trac. Lt. & Pwr.	5s	1962	107	86	105
Aluminum Co. of Amer.	7s	1933	106½	106½	107½
Amer. Bosch Magneto	8s	1936	*l*103	86	101
Amer. Gas & Elec.	5s	2007	91	90	93½
Amer. Gas & Elec.	6s	2014	98½	96½	98½
Amer. Pwr. & Lt.	6s	2016	95½	94	98
Amer. Pub. Serv.	6s	1942	98½	94	99½
Amer. Wtr. Wks. & Elec.	5s	1934	95½	92½	98
Amer. Wtr. Wks. & Elec.	6s	1975	94½	94½	95
Anaconda Copper	6s	1929	103	102	104
Anaconda Copper	6s	1953	101½	99½	102
Anaconda Copper	7s	1938	104½	99½	105½
Appalachian Pwr.	5s	1941	98½	96	99½
Appalachian Pwr.	6s	2024	93½	86½	94½
Appalachian Pwr.	7s	1936	105½	105½	106½
Arizona Pwr.	6s	1933	100	97½	101½
Arizona Pwr.	6s	1947	95½	90	96
Ark. Central Pwr.	6s	1948	100½	98½	102½
Ark. Lt. & Pwr.	6s	1945	103	100	104½
Ark. Lt. & Pwr.	6s	1954	98	92½	99½
Assoc. Gas & Elec.	6s	1965	93½	92	96
Assoc. Gas & Elec.	6½s	1954	99	94½	106
Binghamton Lt., Ht. & Pwr.	5s	1946	98½	94½	99
Birmingham Elec.	6s	1954	101½	99	103
Birmingham Ry., Lt. & Pwr.	4½s	1954	87½	85	89½
Broad River Pwr.	6½s	1934	100	99	102
Brooklyn Edison	5s	1949	102½	99½	103
Brooklyn Edison	6s	1930	104½	103½	106
Buffalo Gen. Elec. 1st	5s	1939	101½	100½	101½
Buffalo Gen. Elec. 1st & Ref.	5s	1939	101	100	100½
Burlington Ry. & Lt.	5s	1932	94½	90	96
Butte Elec. & Pwr.	5s	1951	100	99	100½
Calif. Gas & Elec.	5s	1937	100½	98	101½
Canadian Lt. & Pwr.	5s	1949	42	36	62
Canton Elec.	5s	1937	99½	99	100½
Carolina Pwr. & Lt.	5s	1938	99½	98½	100½
Carolina Pwr. & Lt.	6s	1953	104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s	1953	99	98½	100½
Central Ark. Ry. & Lt.	5s	1928	99	98½	100
Central Ga. Pwr.	5s	1938	95½	93	97
Central Ill. Lt.	5s	1943	98½	94	99½
Central Ill. Publ Serv.	5s	1952	89½	84½	92½
Central Ill. Pub. Serv.	5½s	1950	96	96½	98
Central Ill. Pub. Serv.	6s	1944	100	96½	101½
Central Ind. Power	6s	1947	98½	95½	99½
Central Ia. Pwr. & Lt.	6s	1944	99	97	100½
Central N. Y. Gas & El.	5s	1941	96½	94	97½
Central Pwr. & Lt.	6s	1946	100½	97½	101½
Central Pwr. & Lt.	6½s	1952	101½	94	102½
Central States Elec.	5s	1926	*l* 99	98	100½
Chattanooga Ry. & Lt.	5s	1956	84	81	85
Cincinnati Gas & Elec.	5s	1956	102	98½	102½
Cincinnati Gas & Elec.	5½s	1967	103½	100½	105
Cities Service	6s	1966	90½	90	91½
Cities Service	7s B	1966	*f*178	....	....
Cities Service	7s C	1966	126½	111	128
Cities Service	7s D	1966	101½	98½	106½
Cities Service	7s E	1966	*f*111	....	....
Cities Service Pwr. & Lt.	6s	1944	93½	93½	95
City Lt. & Trac., Sedalia, Mo.	5s	1952	84	74	85½
Cleveland Elec. Illum.	5s	1939	101½	100	102
Cleveland Elec. Illum.	5s	1954	100½	97½	101
Cleveland Elec. Illum.	7s	1941	110	109	111
Colorado Pwr.	5s	1953	95½	93	96½
Columbia Gas & Elec.	5s	1927	99½	99½	100½
Columbia Ry., Gas & El.	5s	1936	92	92½	94½
Columbus, Dela. & Marion Elec.	5s	1937	85	83	88
Columbus, Dela. & Marion Elec.	6s	1937	95	91	98
Columbus Elec. & Pwr.	6s	1947	*f*102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940	95½	93½	98
Columbus Ry., Pwr. & Lt.	6s	1941	103	101½	105
Commonwealth Edison	5s	1943	102	99½	102½
Commonwealth Edison	5s	1953	99½	98½	101
Commonwealth Edison	5s	1954	99½	98	101
Commonwealth Pwr.	6s	1947	*f*102½	97½	103½
Community Pwr. & Lt.	6s	1950	96	94½	98
Conn. Ry. & Ltg.	4½s	1951	*l* 87	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s	1962	80½	75½	82½
Consol. Elec.	5s	1955	97	94	98½
Consol. Gas of N. Y.	5½s	1945	103½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935	*c* 97½	93½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949	*c*105½	104½	106½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5½s	1952	*k*104	101½	105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s	1965	*c* 99½	98	100½
Con. Gas, Elec. Lt. & Power of Baltimore	5½s	1952	105	101½	105½
Consumers Elec. Lt. & Pwr.	5s	1936	94½	93	96½
Consumers Pwr.	5s	1936	100	99	100½
Consumers Pwr.	5s	1952	97½	90½	100
Consumers Pwr.	5½s	1954	103	99	104½
Continental Gas & Elec.	5s	1927	100	99½	100½
Continental Gas & Elec.	6s	1947	99½	98	101
Continental Gas & Elec.	6½s	1964	98½	96½	101
Continental Gas & Elec.	7s	1954	104½	99	103½
Cumberland County Pwr. & Lt.	5s	1942	94½	92	96½
Dallas Pwr. & Lt.	6s	1949	104½	103	105½
Dayton Ltg.	5s	1937	99½	98½	100½
Dayton Pwr. & Lt.	5s	1941	99½	97	100½
Defiance Gas & Elec.	5s	1942	95	88½	97½
Denver Gas & Elec.	5s	1949	97½	97½	100
Denver Gas & Elec. Lt.	5s	1951	93	92	95½
Des Moines Elec.	5s	1938	98	98	100½
Detroit Edison	5s	1933	102	99½	102½
Detroit Edison	5s	1940	102	99½	102½
Detroit Edison	5s	1949	99½	97½	101½
Detroit Edison	5s	1955	99½	99½	100
Detroit Edison	6s	1932	132	110½	155
Detroit Edison	6s	1940	107½	106½	108½
Detroit Edison	7s	1928	*l* 115½	125	156½
Detroit Edison	7s	1929	*l* 115½	114	150½
Detroit Edison	7s	1930	*l* 140½	121½	158½
Dominion Pwr. & Trans.	5s	1932	95½	95½	98½
Driver-Harris	8s	1931	96	88	97
Dubuque Elec.	6s	1942	101½	97½	102
Duke-Price Pwr.	6s	1949	101	98½	103
Duquesne Lt.	6s	1949	105	104½	107½
Duquesne Lt.	5½s	1949	105½	104	106
Durham Pub. Serv.	7s	1949	100	97½	101½
East Penn. Elec.	6s	1953	104½	100½	105½
East Oregon Lt. & Pwr.	6s	1929	100	97½	100½
East. Tex. Elec.	5s	1942	*j* 95	....	....
Economy Lt. & Pwr.	5s	1956	98½	96	99½
Edison Elec. Illum. of Bkln.	4s	1939	92½	89	96
Edison Elec. Illum. (N. Y.)	5s	1995	102½	99½	103
El Paso Elec.	5s	1932	*j* 102	....	....
El Paso Elec.	5s	1950	*j* 94	....	....
Elec. Pwr. Corp. (Germany)	6½s	1950	87½	86½	88½
Elmira Wtr., Lt. & R.R.	5s	1956	95	92½	96½
Empire Dist. Elec.	5s	1949	91	86½	91½
Erie Ltg.	5s	1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s	1932	98½	96	100
Federal Lt. & Trac.	5s	1942	91½	88	96
Federal Lt. & Trac.	6s	1942	100½	96½	103
Federal Lt. & Trac.	6s	1954	92½	91½	94½
Ft. Smith Lt. & Trac.	5s	1936	78½	76½	82½
Ft. Worth Pwr & Lt.	5s	1931	99½	99	100½
Galveston Elec.	5s	1940	91	86½	93½
General Elec.	3½s	1942	87	83	90½
General Elec.	5s	1952	*k*107½	101½	107½
Georgia Carolina Pwr.	5s	1952	85½	82	90
Ga. Lt., Pwr. & Rys.	5s	1941	87½	86½	90½
Ga. Ry. & Elec.	5s	1932	98½	98½	100½
Ga. Ry. & Elec.	5s	1949	92	88	94½
Ga. Ry. & Pwr.	5s	1954	93½	89½	96
Ga. Ry. & Pwr.	6s	1947	102½	100½	103½
Ga. Ry. & Pwr.	7s	1941	104½	105	107
German Gen. Elec.	7s	1945	95½	92	96½
Great Cons. Elec. Pwr. (Japan)	6½	1950	86	85½	86½
Great Cons. Elec. Pwr. (Japan)	7s	1944	90½	87½	92
Great Falls Pwr.	5s	1940	103½	99½	103½
Great Northern Pwr.	5s	1935	98½	96	99
Great Western Pwr.	5s	1946	98½	95	99½
Great Western Pwr.	5½s	1955	98	96	99
Great Western Pwr.	6s	1949	100½	100	102½
Great Western Pwr.	6s	1952	101½	99½	102½
Hamburg Elec.	7s	1935	95½	95½	96
Havana Elec. Ry., Lt. & Pwr.	5s	1954	92½	85½	95½
Holtwood Pwr.	6s	1954	100	100	104½
Houston Ltg. & Pwr.	5s	1931	99½	198½	100
Houston Ltg. & Pwr.	5s	1953	93½	90½	95½
Houston Ltg. & Pwr.	5½s	1954	99½	97	101½
Hydraulic Pwr.	5s	1951	101	99½	102
Hydraulic Pwr.	5s	1950	101	100	103
Idaho Pwr.	5s	1947	96½	93	97½
Ill. Elec. Pwr.	6s	1943	102	99½	103½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco. *i*Pittsburgh. *j*Bid, low, high, Tuesday, Dec. 1. *k*Bid, low, high, Wednesday, Dec. 2. ‖Latest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday, Nov. 28	Low 1925	High 1925
BONDS (Continued)				
Ill. Pwr.	5s	1933	93¼	93	95¼
Ill. Pwr. & Lt.	6s	1953	101¼	100¼	102
Ill. Pwr. & Lt.	7s	1953	103	99	102¼
Ind. Elec.	6s	1947	98	97	99¼
Ind. Gen. Serv.	5s	1948	96	92	97½
Ind. Lighting	4s	1958	80½	78	83
Indiana & Mich. Elec.	5s	1957	98½	97½	99½
Indiana & Mich. Elec.	5s	1955	95	95	98
Ind. Pwr.	7½s	1941	ƒ105½	104	106
Ind. Service	5s	1950	89½	86½	92
Ind. Service	6s	2020	85	73	88½
Ingersoll-Rand	5s	1935	99¾	92	99¾
Interstate Elec.	6s	1933	95	95	99½
Interstate Pwr.	6s	1944	98	95	99½
Interstate Pwr.	7s	1934	99¾	97	100½
Interstate Pub. Serv.	6s	1948	98	96	100½
Iowa Ry. & Lt.	5s	1932	97¾	97	99½
Jersey Cent. Pwr. & Lt.	5½s	1945	95½	95	98
Kansas City Pwr. & Lt.	5s	1952	99¾	95½	102
Kansas Elec. Pwr.	6s	1937	100	97	102
Kansas Elec. Pwr.	6s	1943	100½	97	102
Kansas Gas & Elec.	6s	1952	102	98	103½
Kansas Gas & Elec.	6s	2022	91½	86	94½
Kentucky Utilities	6s	1949	100¼	97	101½
Kings County Elec. Lt. & Pwr.	5s	1937	102½	99	103
Kings County Elec. Lt. & Pwr.	6s	1997	120	114½	120½
Kings County Ltg.	5s	1954	98½	89	101½
Kings County Ltg.	6½s	1954	107½	103½	108½
Knoxville Ry. & Lt.	5s	1946	93	88	95½
Laclede Gas Lt.	5s	1934	100	98½	101¾
Laclede Gas Lt.	5½s	1953	100¾	95½	102
Laurentian Pwr.	6s	1936	100	96	100½
Laurentide Pwr.	6s	1936	k99	96	100
Laurentide Pwr.	5s	1946	99½	97	100½
Laurentide Pwr.	6s	1936	299	....	....
Lehigh Pwr. Sec. (notes)	6s	1927	101	100½	101½
Lincoln Gas & Elec.	5s	1941	91	92½	95½
Long Island Ltg.	5s	1936	99½	98	100½
Long Island Ltg.	6s	1954	99½	99	102
Long Island Ltg.	6s	1948	104½	102	105½
Los Angeles Gas & Elec.	5s	1939	99	98	101½
Los Angeles Gas & Elec.	5½s	1943	98	94	99½
Los Angeles Gas & Elec.	5½s	1947	98	96	99½
Los Angeles Gas & Elec.	5½s	1949	97½	95½	99½
Los Angeles Gas & Elec.	6s	1942	102½	101½	104½
Louisiana Pwr.	6s	1944	97½	97	99
Louisville Gas & Elec.	5s	1952	98	90½	99½
Louisville Gas & Elec.	5½s	1954	101½	99	102
Lower Austrian Hydro Elec.	6½s	1944	86	85½	86½
Luzerne County Gas & Elec.	5s	1948	98	97	99½
Luzerne County Gas & Elec.	7s	1944	104½	99½	104½
Luzerne County Gas & Elec.	6s	1954	102½	99	105
Madison River Pwr.	5s	1935	100	99½	101
Manila Elec.	7s	1942	101½	97½	103
Manila Elec. Ry. & Ltg.	5s	1953	89	85	92
Manitoba Pwr.	7s	1941	103½	98½	104½
Memphis Pwr. & Lt.	5s	1948	98½	95	99½
Metropolitan Edison	6s	1952	104½	101½	106½
Metropolitan Edison	5s	1953	95½	91½	97
Metropolitan Pwr.	6s	1953	102	100	104
Michigan Lt.	5s	1946	98	97½	100
Michigan No. Pwr.	5s	1941	96	95½	97
Milwaukee Elec. Ry. & Lt.	5s	1926	100	99½	101½
Milwaukee Elec. Ry. & Lt.	4½s	1931	96½	94½	97
Milwaukee Elec. Ry. & Lt.	5s	1951	98	94	100
Milwaukee Elec. Ry. & Lt.	5s	1961	89½	84½	92½
Milwaukee Elec. Ry. & Lt.	6s	1953	100	98½	104
Minn. Pwr. & Lt.	5s	1955	95	95	97
Minn. Pwr. & Lt.	6s	1950	103½	101½	105½
Miss. River Pwr.	5s	1951	99	96½	100½
Miss. River Pwr.	7s	1935	102	102	104
Mo. Edison Elec.	5s	1927	ƒ99½	99½	100½
Mobile Elec.	5s	1946	96	91	97½
Montana Pwr.	5s	1943	100½	97½	100½
Montgomery Lt. & Wtr. Pwr.	5s	1943	ƒ93	86½	93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	98½	98½	101
Montreal Pub. Serv.	5s	1942	94½	89	94½
Mountain States Pwr.	6s	1938	98½	96½	100½
Nashville Ry. & Lt.	5s	1953	97	94	98
Nashville Ry. & Lt.	5s	1958	89½	84	88½
Nassau Lt. & Pwr.	5s	1927	99½	98	101
Nassau & Suffolk Ltg.	5s	1945	89	82	91
National Pwr. & Lt.	7s	1972	102	97	104½
National Pub. Serv.	6½s	1955	94½	94	96½
Nebraska Pwr.	5s	1949	99½	97	100
Nebraska Pwr.	6s	2022	96	89½	96½
Nevada-Calif. Elec.	6s	1946	99	96½	100½
Nevada-Calif. Elec.	6s	1950	99	96½	100½
New England Pwr.	5s	1951	101	100½	103
New Jersey Pwr. & Lt.	5s	1936	96½	92½	97½
New Orleans Pub. Serv.	4½s	1935	86½	83½	88½
New Orleans Pub. Serv.	5s	1952	90	89½	92
New Orleans Pub. Serv.	5s	1955	89½	88½	92½
New Orleans Pub. Serv.	6s	1949	92	86½	93½
N. Y. & Queens Elec. Lt. & Pwr.	5s	1930	99½	99½	101
N. Y. & Westchester Ltg.	4s	2004	78	76	81
N. Y. & Westchester Ltg.	5s	1954	96	93	97
New York Edison	6½s	1941	114½	112	115½
New York Edison	5s	1944	102	99½	102
N. Y. Gas & Elec. Lt., Ht. & Pwr.	5s	1948	103½	100½	104½
N. Y. Gas & Elec. Lt., Ht. & Pwr.	4s	1949	88½	86	90½
N. Y. State Gas & Elec.	5½s	1962	100½	96	101½
Newport News & Hampton Ry., Gas & Elec.	5s	1944	85	84	93
Niagara Falls Pwr.	5s	1932	101	99½	103
Niagara Falls Pwr.	6s	1932	105½	103½	106½
Niagara Falls Pwr.	6s	1950	105½	103½	106½
Niagara, Lock. & Ont. Pwr.	5s	1954	ƒ98½	104½	110
Niagara, Lock. & Ont. Pwr.	5s	1955	98½	97½	100
Niagara, Lock. & Ont. Pwr.	6s	1958	ƒ109½	104½	110½
Norfolk Ry. & Lt.	5s	1949	94	93	95½
No. Amer. Edison	6s	1952	101	96½	102½
No. Amer. Edison	6½s	1948	104½	100½	106
No. Amer. Lt. & Pwr.	7s	1954	99½	97	100
North Caro. Pub. Serv.	5s	1934	90½	89	93½
North Caro. Pub. Serv.	6s	1954	94	91½	96
North Caro. Pub. Serv.	6½s	1944	98	96	100
North Shore Elec.	5s	1940	99½	97½	100
No. Calif. Pwr.	5s	1948	99½	98½	100½
No. Ind. Gas & Elec.	5s	1929	99	97	100½
No. Ind. Gas & Elec.	6s	1952	102	99½	103½
Northern N. Y. Utilities	5½s	1949	99	96½	100½
No. Ohio Trac. & Lt.	4s	1933	87	82	87½
No. Ohio Trac. & Lt.	5s	1956	83	78	87
No. Ohio Trac. & Lt.	6s	1926	98½	98½	100
No. Ohio Trac. & Lt.	6s	1947	94½	91	97
No. Ontario Lt. & Pwr.	6s	1931	98½	95½	99½
No. States Pwr.	6½s	1933	137½	105½	141
No. States Pwr. (notes)	6½s	1933	103½	99½	104½
No. States Pwr.	6s	1948	102½	101	104½
No. States Pwr.	6s	1941	104½	103	107½
No. States Pwr.	5s	1941	97½	93	99½
No. Tex. Elec.	5s	1940	74	74	82½
Northwestern Elec.	6s	1935	101	101½	102½
Northwestern Pub. Serv.	6½s	1948	99	97½	100½
Ohio Pwr.	5s	1952	93½	89½	96
Ohio Pwr.	6s	1953	103	101	104½
Ohio Pwr.	6s	2024	95½	88½	95½
Ohio Pwr.	7s	1951	106	106½	107½
Ohio Pub. Serv.	5s	1954	91	87	93
Ohio Pub. Serv.	6s	1953	100½	98	101½
Ohio Pub. Serv.	7½s	1946	112½	108	112½
Ohio Pub. Serv.	7s	1947	110½	107½	111½
Ohio River Edison	6s	1948	101	98	104
Okla. Gas & Elec.	5s	1950	92½	93½	96
Okla. Gas & Elec.	6s	1940	96½	96	98½
Ontario Pwr. of Niagara Falls	5s	1943	100	98	100½
Ontario Transmission	5s	1945	99½	97	99½
Ozark Pwr. & Wtr.	5s	1952	76	75	81
Pacific Coast Pwr.	5s	1940	99½	97½	99½
Pacific Gas & Elec.	5s	1942	97½	93½	99
Pacific Gas & Elec.	5s	1955	ƒ93½	94	95½
Pacific Gas & Elec.	5½s	1952	101½	97½	102½
Pacific Gas & Elec.	6s	1941	105½	103½	106½
Pacific Lt. & Pwr.	5s	1951	99½	98½	100½
Pacific Lt. & Pwr.	5s	1942	99½	98	101½
Pacific Pwr. & Lt.	5s	1930	99½	98	100
Pacific Pwr. & Lt.	5s	1953	ƒ96½	....	....
Parr Shoals Pwr.	5s	1952	93	92½	97
Paterson & Passaic Gas & Elec.	5s	1949	99½	96	100½
Penn Central Lt. & Pwr	6s	1953	103	102	104½
Penn Edison	5s	1946	96½	94	97½
Penn Elec.	6½s	1954	98½	96	99½
Penn. Elec.	6s	1955	93½	93½	95
Penn Ohio Elec.	6½s	1938	105	99½	105
Penn Ohio Pwr. & Lt.	5½s	1954	97½	95	99½
Penn Ohio Pwr. & Lt.	6s	1939	97½	94	99
Penn Pwr. & Lt.	5s	1952	97½	95	98½
Penn Pwr. & Lt.	5s	1953	97½	95	98½
Penn Pwr. & Lt.	6s	1953	104½	102½	105½
Penn Pwr. & Lt.	7s	1951	106	106	107½
Penn Pub. Serv.	5s	1954	95	93	96½
Penn Pub. Serv.	6s	1947	103	103	105½
Penn Wtr. & Pwr.	5s	1940	101½	99½	102½
Penn Wtr. & Pwr.	5½s	1953	102	99½	103
Phila. Co.	6s	1944	103½	101½	105
Phila. Co.	5½s	1938	98½	93½	100
Phila. Co.	5s	1951	94½	95	97
Phila. Co.	5s	1949	ƒ102½	94½	104
Phila. Elec.	6s	1941	c107½	106	108½
Phila. Elec.	5s	1966	c102½	100	104½
Phila. Elec.	4s	1966	c85	83	85½
Phila. Elec.	5s	1960	c101	100	104
Phila. Elec.	5½s	1947	c106½	103½	107
Phila. Elec.	5½s	1953	c106½	104½	107½
Portland Elec. Pwr.	6s	1947	99½	96½	100½
Portland Gen. Elec.	5s	1935	97½	98½	100½
Portland Ry., Lt. & Pwr.	5s	1942	89½	84½	92
Portland Ry., Lt. & Pwr.	6s	1947	98½	94	100½
Portland Ry., Lt. & Pwr.	7½s	1946	106½	104½	108
Potomac Edison	6s	1949	98½	96	100
Potomac Edison	6½s	1948	102	99	103½
Potomac Elec. Pwr.	5s	1929	99½	99	100½
Potomac Elec. Pwr.	5s	1936	99½	98½	100
Power Corp. of N. Y.	6s	1942	99½	97½	101
Power Corp. of N. Y.	6½s	1942	104	99½	103½
Power Securities	6s	1949	ƒ79	....	....
Pub. Lt. & Pwr.	5s	1945	68	64	79
Pub. Serv. Co. of Colo.	5½s	1954	93½	92	96½
Pub. Serv. Co. of Colo.	6s	1953	99	98	101
Pub. Serv. Co. of Colo.	7s	1933	101	98½	102½
Pub. Serv. Corp. of N. J.	5s	1959	104½	103½	105½
Pub. Serv. Corp. of N. J.	6s	1944	99½	95	100
Pub. Serv. Co. of No. Ill.	5s	1956	96½	91	97½
Pub. Serv. Co. of No. Ill.	5½s	1962	101½	96½	102½
Pub. Serv. Co. of No. Ill.	5½s	1964	101½	96½	102½
Pub. Serv. Co. of Okla.	6s	1949	99	97½	103
Pub. Serv. Elec. & Gas.	5½s	1959	103½	98½	105½
Pub. Serv. Elec. & Gas.	5½s	1964	103½	99½	105
Public Utilities, (Evansville, Ind.)	6s	1929	100	99	101
Puget Sound Pwr.	5s	1933	98½	98½	100½
Puget Sound Pwr. & Lt.	5½s	1949	99½	96½	100½
Quebec Pwr.	6s	1953	101½	98½	102½
Queensborough Gas & Elec.	5s	1952	99	96½	100½
Queensborough Gas & Elec.	6s	1953	104½	101	105
Rhine-Westphalia Electric Power	7s	1950	94½	94½	95
Rio de Janeiro Tram., Lt. & Pwr.	5s	1935	93	85	91½
Robbins & Myers	7s	1952	60½	57½	73½
Rochester Gas & Elec.	5½s	1948	103½	102	104½
Rochester Gas & Elec.	7s	1946	110½	109½	111
Rockford Elec.	5s	1939	99½	98	101
St. Joseph Ry., Lt., Ht. & Pwr.	5s	1937	91	85½	93
St. Paul Gas Lt.	5s	1944	100	98½	100½
St. Paul Gas Lt.	5½s	1954	101½	98	102½
Salt River Valley Wtr.	6s	1938	£100	....	....
Salmon River Pwr.	5s	1952	100½	98½	101½
San Antonio Gas & Elec.	5s	1949	97	96	98½
San Antonio Pub. Serv.	6s	1952	101½	99½	104
San Diego Cons. Gas & Elec.	5s	1939	100	98	101
San Diego Cons. Gas & Elec.	6s	1939	101½	99	103
San Joaquin Lt. & Pwr.	5s	1945	98½	98	100
San Joaquin Lt. & Pwr.	6s	1950	102½	101	103½
San Joaquin Lt. & Pwr.	6s	1952	101	99½	103½
San Joaquin Lt. & Pwr.	6s	1954	100½	99	101
Sauda Falls	5s	1955	98½	98	98½
Savannah Elec. & Pwr.	7½s	1941	ƒ104½	....	....
Saxon Pub. Wks. (Germany)	7s	1945	93½	90½	94½
Scranton Electric	5s	1937	99½	99½	101½
Seattle Elec.	.s	1930	99½	99½	101
Seattle Elec.	5s	1929	100	99	100½
Seattle Elec.	5s	1939	92½	90	93½
Seattle Ltg.	5s	1949	91½	85½	92
Shawinigan Wtr. & Pwr.	5s	1934	100	100	101½
Shawinigan Wtr. & Pwr.	5½s	1950	103½	101½	104
Shawinigan Wtr. & Pwr.	6s	1950	105	104	106½
Siemens & Halske	7s	1928	96½	92½	99½
Siemens & Halske	7s	1935	95	90½	96½
Sierra & San Francisco Pwr.	5s	1949	77	75	80
Sierra & San Francisco Pwr.	6s	1949	89	87	93½
Sioux City Gas & Elec.	6s	1947	101½	99	102
Sioux City Gas & Elec.	6s	1949	101½	99	102
So. Caro. Gas & Elec.	6s	1942	84	87	93
So. Caro. Gas & Elec.	6s	1932	75	83	88
Southeast Pwr. & Lt.	6s	2025	90½	88	94½
So. Cal. Edison	5s	1939	99½	99½	101
So. Cal. Edison	5s	1944	95	92½	96½
So. Cal. Edison	5½s	1944	101½	98½	102
So. Cal. Edison	6s	1943	102½	100½	104
So. Cal. Edison	6s	1944	104½	102½	105½
So. Cities Utilities	8s	1931	99	99	102
Southern Colo. Power	6s	1947	98	93½	99½
So. Public Utilities	5s	1943	99½	97½	100
So. Sierras Pwr.	6s	1936	102½	102	104½
So. Utilities	6s	1933	102	97½	102½
So. Wisconsin Pwr.	5s	1938	90	88	93
Southwestern Gas & Elec.	5s	1932	96½	94	98
Southwestern Gas & Elec.	6s	1957	96½	89	97½
Southwestern Pwr. & Lt.	5s	1943	94½	90	97
Southwestern Pwr. & Lt.	6s	2022	93½	88½	94½
Southwestern Utilities	8s	1936	97	96	102
Springfield Ry. & Lt.	5s	1926	99½	98½	100½
Standard Elec. of Cal.	5s	1939	98½	98½	100½
Standard Gas & Elec.	6s	1935	99½	91	101
Staten Island Edison	6½s	1953	104½	104	106½
Syracuse Ltg.	5s	1951	99½	97½	100½
Syracuse Ltg.	5½s	1954	102	100½	103
Tampa Elec.	5s	1933	ƒ99	....	....
Tenn. Elec. Pwr.	6s	1947	102½	99½	104½
Tenn. Pwr.	5s	1962	94½	90	96½
Tex. Pwr. & Lt.	5s	1937	98	97	99½
Tex. Pwr. & Lt.	6s	2022	95½	90	96½
Tide Water Pwr.	6s	1942	99½	98½	101
Tide Water Pwr.	7s	1937	98½	97½	101½
Toho Elec. Pwr. (Japan)	7s	1955	90½	87	91½
Tokyo Elec. (Japan)	6s	1928	99	98½	99½
Toledo Edison	5s	1947	98½	97	100
Toledo Edison	7s	1941	ƒ108½	108½	110
Toledo Gas Elec. & Htg.	5s	1935	96½	97½	100½
Toledo Trac., Lt. & Pr. notes	5½s	1930	98½	97½	100½
Topeka Edison	5s	1930	98½	97	100
Topeka Ry. & Lt.	5s	1933	95	90½	96½
Trenton Gas & Elec.	5s	1949	99½	98	100
Tri-City Ry. & Lt.	5s	1930	98½	96½	99½
Twin State Gas & Elec.	5s	1953	92½	84	94½
Tyr-l Hydro-Elec. Pwr.	7½s	1955	96½	94½	97
Union Elec. Lt. & Pwr.	5s	1932	101½	99½	102
Union Elec. Lt. & Pwr.	5s	1933	100	98½	101
Union Elec. Lt. & Pwr.	5s	1954	99	97½	100
Union Elec. Lt. & Pwr.	5½s	1954	100½	100	104
United Elec. of N. J.	4s	1949	87½	85	88½
United Elec. Lt. & Pwr.	4½s	1929	ƒ98½	98½	99
United Gas & Elec.	6s	1945	99	96	101
United Lt. & Pwr. notes	5½s	1928	99½	98	100
United Lt. & Pwr.	5½s	1959	94½	89½	97
United Lt. & Pwr.	6½s	1974	97	92½	97½
United Lt. & Rys.	5s	1932	95½	93½	97½
United Lt. & Rys.	6s	1926	99½	100½	101½
United Lt. & Rys.	6s	1952	98½	95½	100½
United Lt. & Rys.	6s	1973	90	87	92
United Pwr. & Lt.	6s	1944	101½	99	103
Utah Lt. & Trac.	5s	1944	87½	8½	91½
Utah Pwr. & Lt.	5s	1944	95	91	98½
Utah Pwr. & Lt.	6s	1944	102½	102	104½
Utah Pwr. & Lt.	6s	2022	92½	88½	94½
Utica Elec. Lt. & Pwr.	5s	1950	101½	100½	102
Utica Gas & Elec.	5s	1957	100½	98½	103
Vermont Hydro-Elec.	6s	1929	100	98½	100½
Vicksburg Lt. & Trac.	5s	1932	91	89	93½
Virginian Pwr.	5s	1942	93½	88	96
Virginian Pwr.	6½s	1954	101½	99	102½
Virginia Ry. & Pwr.	5s	1943	97½	93½	99
Wagner Elec. Mfg.	7s	....	ƒ101½	100	102
Washington Coast Util.	6s	1941	101½	99½	101½
Washington Wtr. Pwr.	5s	1939	101½	99½	101½
West Penn Pwr.	5s	1963	99½	93½	100
West Penn Pwr.	5s	1946	99½	93½	100½
West Penn Pwr.	5½s	1953	104	100½	105½
West Penn Pwr.	7s	1946	106½	104½	107½
West Virginia Lt., Ht. & Pwr.	6s	1929	100	95	100
West Virginia Utilities	6s	1935	95	91	98
Westchester Ltg.	5s	1950	101½	98	102
Western Elec.	5s	1944	100½	98	101½
Western N. Y. Utilities	5s	1946	96½	90½	97½
Western Pwr.	6½s	1954	100	97	100½
West. States Gas & Elec.	5s	1941	97½	95	99½
West. States Gas & Elec.	6s	1947	99	97	100½
Westinghouse Elec. & Mfg.	7s	1931	105½	105½	108½
Westphalia Un. Elec. Pr.	6½s	1950	d 87½	87½	87½
Wisconsin Elec. Pwr.	5s	1954	98½	93½	99
Wisconsin Gas & Elec.	5s	1952	99	97	100½
Wis.-Minn. Lt. & Pwr.	5s	1944	95½	93	96½
Wis. Ry., Lt. & Pwr.	5s	1933	92½	87½	93½
Wis. River Pwr.	5s	1941	90½	88	92½
Yadkin River Pwr.	5s	1941	98½	96½	99½
Yarmouth Lt. & Pwr.	5s	1937	83	82	87
Yarmouth Lt. & Pwr.	8s	1951	98	97	102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. iPittsburgh. jBid, low, high, Tuesday, Dec. 1. kBid, low, high, Wednesday, Dec. 2. lLatest quotations available.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Central-Station Industry in the South Central States

THE transition of the Old South into the New South is nowhere more clearly pictured than in the growth in the use of electrical energy. The Southern States are essentially an agricultural section, and manufacturing on a large scale has been but the development of the past five or six years. It was natural in searching for a means of increasing the manufacturing activities of the South that electrical energy should be called upon to run the newly installed machinery. As a result the rate of increase in the activities of the central-station companies operating in the South Central States since 1919 has been far greater than that experienced in any other section of the nation.

Back in September, 1920, the average daily output of these Southern companies was 7,195,000 kw.-hr., while in September, 1925, this average daily output was 13,550,000 kw.-hr., an increase of 89 per cent. In September, 1920, the New England States led the South Central States by 455,000 kw.-hr. in daily energy consumption, while last September the South Central States led the New England States by 1,830,000 kw.-hr. per day.

The operations during the present year are many per cent above the estimated normal for the region, this normal being based upon the activities of the industry in the South during the past five years. The South Central States are the only section in the country which has reported materially increased operations over the normal based on operations for the past five years. Some other sections have been operating above this normal during 1925, but in these cases this abnormal activity has been confined to 2 or 3 per cent above normal. A study of the accompanying diagram would indicate that the central-station industry in the South is just beginning to set its pace for annual growth.

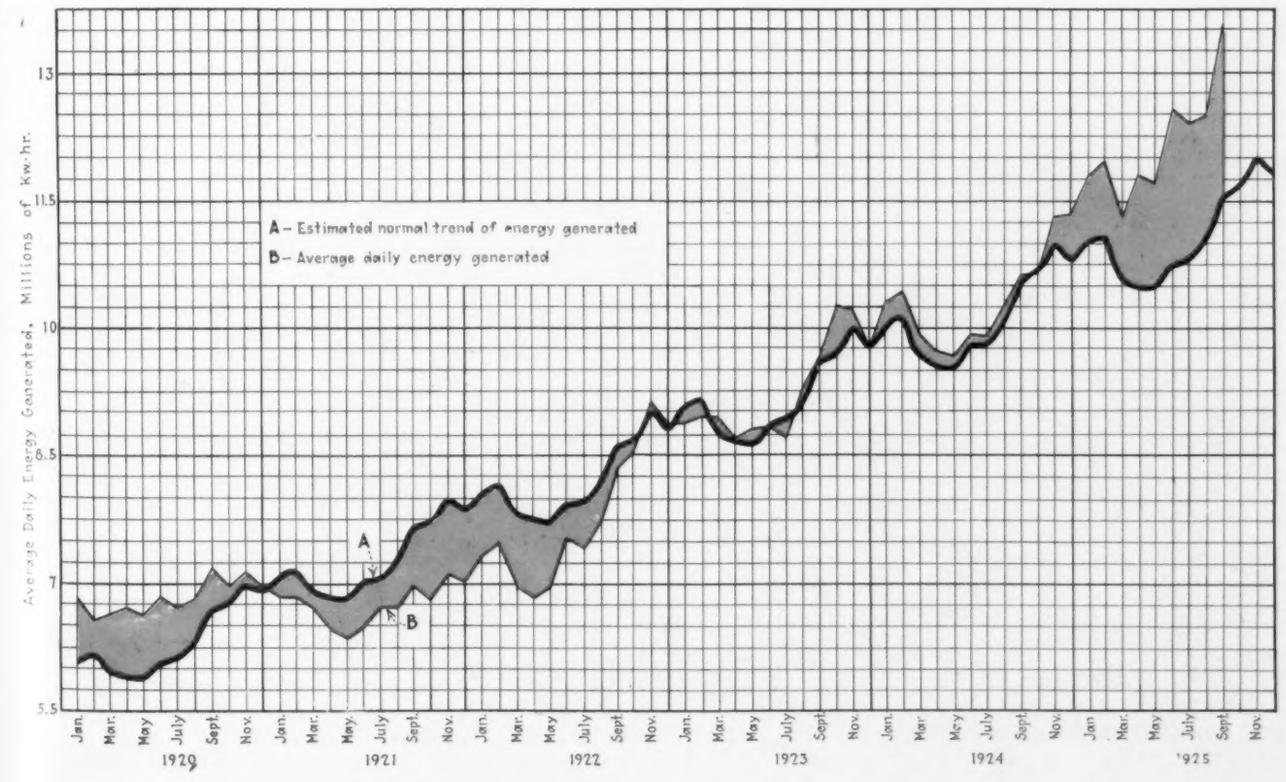
Some idea of the progress made by the central-station industry in the South Central States since the war is to be drawn from the fact that the energy generated has increased from 2,502,024,000 kw.-hr. in 1920 to an estimated 4,428,000,000 kw.-hr. in 1925; value of plant and equipment has increased from $307,700,000 to $436,000,000, gross revenue from $68,050,000 to $117,000,000, customers served from 783,000 to 1,670,470, number of employees from 11,285 to 16,460, rating of installed generators from 930,700 kva. to 1,714,000 kva., water-power development from 250,000 hp. to 375,000 hp., and that during this six-year period the industry has spent a total of $122,285,000 for additions and extensions.

All indications point to a much greater growth during 1926.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Energy Generated by Central Stations of the South Central States

(100 per Cent of the Industry)



Purchasing Power of the Central Station

THERE are two angles from which the activities of an industry may be judged—its annual output of the article manufactured and its own requirements for raw material and supplies needed in the manufacture and distribution of that article. In the first instance the industry supplies the requirements of a market, and in the second instance it creates a market within itself. The dollars-and-cents value of this self-created market must be, of course, materially under that of the market which absorbs the manufactured product of the industry, or else the industry would be operating at a continual loss—an economic impossibility. But in an industry of large operations this industry-market or industrial purchasing power becomes one of large proportions, and this is especially true of a type of industry, such as the electric light and power companies, in which the aggregate investment in plant and equipment is several times the annual gross revenue.

The purchasing power of the electric light and power industry in the United States during 1925 is placed at $632,350,000 for additions and extensions to generation, transmission and distribution equipment. In addition to this amount approximately fifty million dollars was spent during 1925 for new administrative quarters, warehouses, etc., so that the annual purchasing power of the central-station industry amounts to a very considerable sum, even in this day of large figures.

It is a well-established fact, however, that purchasing power is dependent upon certain economic conditions. Just as in the human family, standards have been set up, which, by reason of environment, education and financial conditions, determine the probable purchasing power of any class of people, so in industry operating companies naturally fall into certain classifications, each one of these companies with its probable purchasing power determined by underlying conditions.

According to the latest census there are 1,798 electric light and power companies in the United States which do not generate any electrical energy at all, purchasing their entire output from other utilities. These companies—28 per cent of the total number of operating companies—have no potential buying power in so far as power-house and generator equipment is concerned, and in all but a few instances have no potential buying power for high-tension transmission-line equipment, being only low-tension distributing companies. Not only is this true, but a special survey of growth in the activities of the industry indicates that only 66 per cent of the generating companies having plants under 1,000 kw. can be counted on to make annual expenditures for additions and extensions to their generation, transmission and distribution equipment. Companies of this low generator rating serve small, slowly developing communities, the power load in a large majority of instances being less than the lighting load.

There are 1,314 central-station companies, either of this class or purchasing companies with a transformer rating under 1,000 kw., which do not have any day service at all, their service being confined entirely in the lighting of homes, stores and streets in the evening. This survey of the industry also indicates that companies with a generator rating above 1,000 kw. annually, with but very few exceptions, budget certain amounts for additions and extensions to their generation, transmission and distribution systems to take care of growth in the territory served.

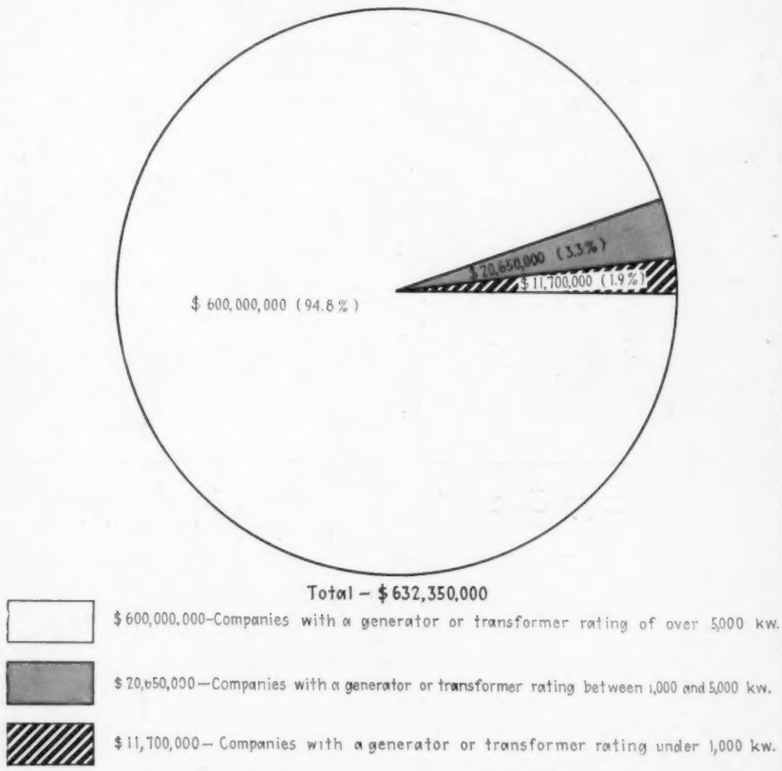
We have, therefore, three types of operating companies, each with a varying degree of purchasing power—companies which purchase all their energy, spending nothing on generator equipment and little or nothing on transmission equipment, their expenditures being confined almost entirely to distribution equipment; companies with a small generator or transformer rating, whose operations are so small that in a third of the cases they do not call for annual construction budgets to take care of growth; and companies which are increasing their operations at such a rate as to call for annual construction budgets.

A careful study of these three types of operating companies indicates that of the $632,350,000 spent by the electric light and power companies of the country during 1925 for additions and extensions to their generation, transmission and distribution systems, a total of 95 per cent, or $600,000,000, was spent by companies having a generator rating or transformer rating in excess of 5,000 kw.

Of the $32,350,000 spent by companies under 5,000 kw., $19,800,000 was spent by companies having a generator or transformer rating between 1,000 kw. and 5,000 kw. The remaining $12,550,000, or 1.98 per cent of the total, was spent by the 5,497 companies having a generator or transformer rating under 1,000 kw.

The buying or purchasing power of the central-station industry, therefore, is not to be judged by the number of operating companies, but must be judged solely on the necessity for budgeting construction expenditures by each of these operating companies, based on their type of load and their rate of load expansion. Each company is a creature of its own environment, which is reflected directly in its purchasing power.

Distribution of Central-Station Expenditures for Additions and Extensions to Generation, Transmission and Distribution Equipment During 1925 in Accordance with the Size of Operating Companies


$ 600,000,000 (94.8%)
$ 20,650,000 (3.3%)
$ 11,700,000 (1.9%)
Total – $ 632,350,000
$ 600,000,000—Companies with a generator or transformer rating of over 5,000 kw.
$ 20,650,000—Companies with a generator or transformer rating between 1,000 and 5,000 kw.
$ 11,700,000—Companies with a generator or transformer rating under 1,000 kw.